Telephone Engineer

Volume 33 JANUARY, 1929 No. 1

When Is a Main Line Telephone? With the development of the hotel type of apartment house in larger cities and in some of the smaller cities has arisen a new type of public utility service difficulty. In an eastern state recently an owner of such an apartment house filed a complaint that an electric utility refused to furnish service to his building. Investigation showed that the owner asked to have one large meter installed for the building and that it was proposed to have installed by a separate private concern, individual meters for the various apartments.

The tenants were to be billed by the owner for electric service at the standard rate for such service if furnished by the electric company, the owner and the private meter corporation splitting the "rake-off" of the difference between these retail rates and the wholesale rate paid the central station for energy as shown by the master meter. The public service commission, very properly we think, ruled that such an arrangement was unfair to the central station and that it was not required to give service under these conditions.

A similar condition arises in telephone service where a private branch exchange is installed with a terminal in each apartment. Where measured service is the rule, the rate per call on the number of calls of an individual tenant is usually higher than the rate per call for the number of calls from the building as a whole. Recognizing that the owner is at some expense in operating the p. b. x., telephone companies usually installed service without inquiring into charges between owner and tenant.

Where the character of the tenants are largely transient, such an arrangement is satisfactory, but occasionally the condition arises where a more or less permanent tenant wishes a listing of his name in the telephone directory. Where this has happened, telephone companies have generally required that the tenant should become a subscriber for a main line telephone service entirely independent of the apartment house system and they have been upheld by commissions in this requirement. This seems to be a fair and sensible solution of what may at times become rather a difficult commercial problem.

Another Toll Rate Cut For the third time in a little over two years, there has been a reduction in long distance telephone rates. These reductions have resulted in the saving of millions of dollars to the long distance telephoneu sers of the country, not so much because their toll bills have been less, but because they have received a much larger amount of service for the same outlay. As far as can be deduced from figures available, the telephone users have not reduced the amount paid for telephone service, but have increased the amount of service used.

In making these reductions, the Bell system is following the expressed policy of the present management to pass back to users the savings that are being effected by advances in the art. It acquires only a rough comparison of the annual charges of a mile of circuit in cable even with loading and necessary repeater equipment against annual charges of a mile of circuit in open wire on poles and a comparison of circuit loads with modern operating methods against circuit loads with older operating methods to show that the savings are substantial.

There has been some speculation each time a reduction has been made as to the effect upon the revenues of connecting companies of the Bell system. Detailed analyses are not available, but the general impression is that any reduction in revenue on account of rate reduction has been offset by increased revenue due to additional business. Of course, there are some connecting company managers who are wondering why it is not possible each time a reduction is made to pass back part

of the reduction to companies originating the traffic instead of passing it all back to the public.

It is true that there has been an increase in originating commissions in the territory of some of the associated Bell companies, while in other territories no changes have been made. Whether or not originating companies in the latter territories are underpaid is a matter which can only be determined by the situation in the particular territory involved. It must be remembered that the interstate rates are set by the parent companies while connecting company commissions seem to be under control of the subsidiary company in each portion of the country. It seems certain that the managements of the subsidiary companies have not been equally generous in their settlement of connecting companies.

While we are not familiar with inter-company relations in the Bell system to the extent of knowing just what allowances are made for origination of long lines traffic, it seems probable that some fairly uniform system is in use over the country. We have not heard of any change in the allowances as the method of passing back the prosperity of the parent company seems to have been in the reduction of license charges rather than in increased toll allowances. We think that it will not be out of order to suggest that the next time the Bell parent company wishes to distribute some of its favors that it pass back at least a portion of the favor to the associated companies in the form of increased commissions on long distance traffic originated with the understanding that this be shared with all connecting companies who have a part in the creation of this traffic.

Announcing the Deci-bel

The christening of a new member of the family of electrical units has just been announced and the inventor of the telephone now has a namesake just as have Ampere, Volta, Faraday and others of his illustrious predecessors in electrical science. The hitherto nameless unit of telephone transmission has been given the name "bel." It must be noted, however, that the unit is ten times that which has been called the transmission unit or t. u. The latter unit which has come into general use in telephone practice on this side of the Atlantic acquired the new name "deci-bel."

While the new name seems strange at first, it is probably no more strange than were the names ohm and henry when they were first applied to the units of resistance and inductance. In a few years the name deci-bel will be as familiar to us as now are the names milli-ampere and micro-farad.

Tell It to Your Editor

As construction activities fall off during the winter season, the effort to provide a proper supply of news material for local newspapers frequently is relaxed also. This occurs at a time when the Christmas advertising rush in the newspaper office has passed and therefore a time when a real live story of local interest is all the more welcome in the office of the news editor.

Whether or not telephone companies have reached the stage of operating on a budget plan, nearly all of them have some definite objectives which they hope to reach during the current year, even if no more than patrolling of lines and minor rebuilding. Now is the time to tell the editor about these plans.

Better still, write up the story on plain paper without heading or signature, telling the facts just as they are and hand them in to the newspaper office as material from which a news story can be written. The more nearly like the form of story used in the local paper the more welcome will be the contribution.

Every construction enterprise of any magnitude whatever can be made the source of at least four newspaper stories; one when it is planned, one when it is started, one during the process of construction and one when it is completed. Now is the time to get the publicity that may be obtained by telling the story of the plans for 1929.

Why Not More Merchandising?

A short time ago, we drove into a small city—one like dozens of other county seat towns in the middle west. On the principal corner of town was the office of the electric company. A large electric sign proclaimed its location and the show windows facing two streets were filled with a splendid display of electrical merchandise.

Upon inquiry we learned the location of the telephone office, which we found in a substantial building but without any special identifying marks and certainly not in a prominent location. We spoke about the difference to the manager of the telephone company, an old acquaintance to whom we could speak plainly, and he gave the following explanation: "The telephone company is in the business of giving service, not of selling merchandise in a legitimate way just as electric companies are doing.

There are a number of accessories that add to the convenience of using the telephone but yet are not properly a part of the service. A display of these accessories and a little selling effort might add a legitimate merchandising profit to the income of the telephone company without in any way interfering with its primary business of giving telephone service.

Inductive Interference

By B. C. BURDEN
Lincoln Tel. & Tel. Co., Lincoln, Nebraska

Inductive interference is one of the by-products of the power companies that pays no dividends. It is, unfortunately, a condition which does the power company no good and the communication company harm. Luckily for all concerned, ways and means have been worked out whereby the ill effects of induction from power and communication parallels may be reduced to a minimum.

The Investigation of the California State Railway Commission

The most noteworthy study and investigation of the "inductive interference problem that has been made was that of the Joint Committee on Inductive Interference of California. This committee was organized in 1913 under the auspices of the Railway Commission for the purpose of developing a better understanding of the subject of inductive interference. It was hoped to acquire sufficient engineering data to enable the establishment of regulations, which would be acceptable to both the power and communication companies, as being effective, reasonable and comprehensive. Almost five years were spent by this committee in gathering data, making actual field tests on high voltage lines and in analyzing the different information gathered. The cost of these investigations totaled more than $100,000. The investigation was completed in 1917 and the results transmitted to the Railway Commission with recommendations for the incorporation into book form of the final report and many of the important technical papers prepared in connection with the research. This suggestion was acted upon, and the important phases of the investigation were compiled into a comprehensive volume of some 1137 pages.

Purpose of This Article

This article is intended to briefly review the elementary theory and some of the more important factors brought out in the above mentioned book for the benefit of those who are not familiar with the basic principles involved in "inductive interference" and its corollary "inductive co-ordination."

Although several years have elapsed since the publication of the book mentioned, its fundamental theory and practice, with a few exceptions, represent best present day practice and knowledge.

Fundamental Theory

It is not, as is generally supposed, the fundamental frequency of power circuit components that create the inductive noises heard on telephone circuits which parallel power circuits. If only frequencies of 60 cycles or less were to be considered, interference between power and telephone lines would be practically negligible.

The inductive noises that we hear come from the higher harmonic frequencies of 3, 5, 7, etc., times the fundamental frequency. The reason for this is the high motional impedance of the diaphragm of a telephone receiver (as well as the human ear drum) at the lower frequencies. The increased reactance of the capacity between power wires and telephone wires in series with the ground as a common plate, also tends to render the lower frequencies harmless in causing inductive noises.

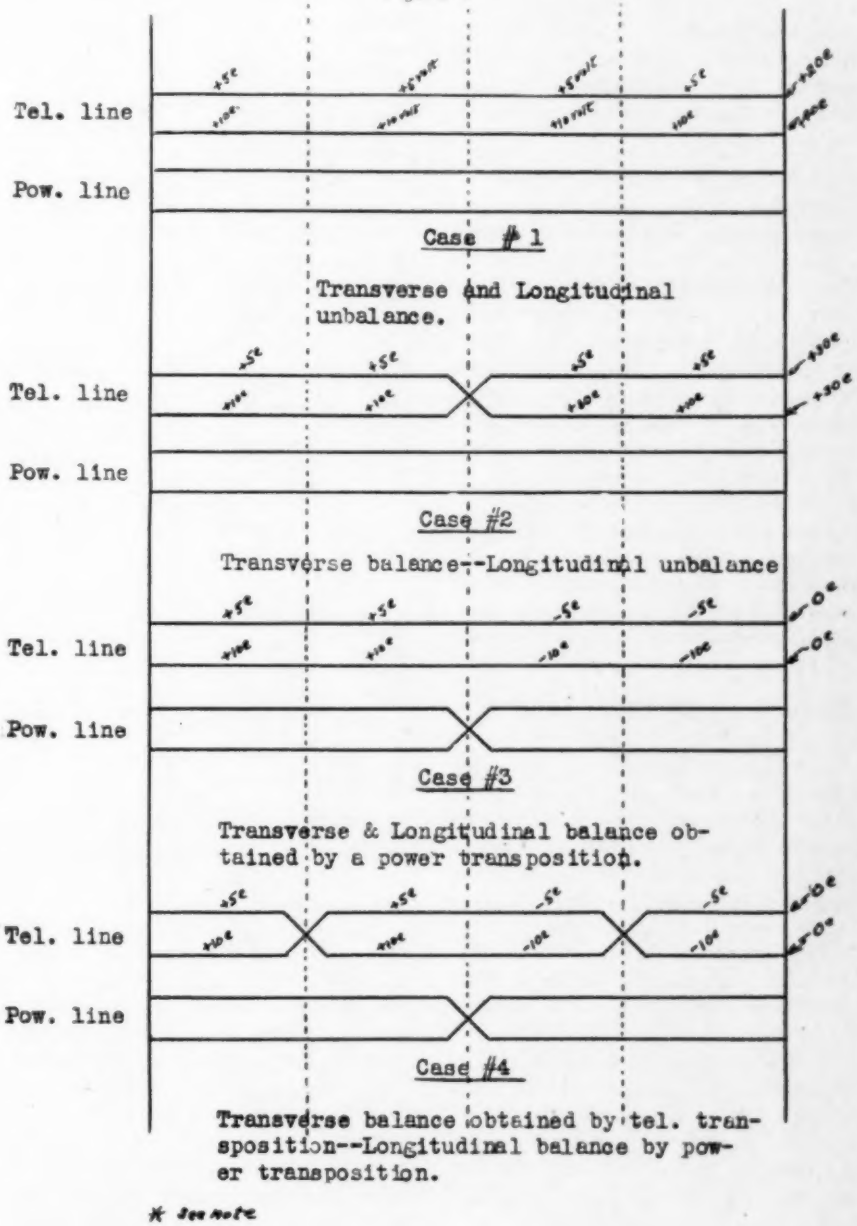
The Two Types of Induction

Power noises are produced in telephone circuits by two different types of induction, which are known as "electrostatic" and "electromagnetic" induction. Electrostatic induction is created by the

---

*Note.—The voltage values shown as induced on the telephone circuits are merely arbitrary assignments for the purpose of illustrating the electrical conditions set up in the four cases.

Figure 1



voltage of the power wire acting across the condenser formed by the power and telephone wires in series with the ground as a common plate. Electromagnetic induction is produced by the magnetic field surrounding the power conductor due to current flow in the power circuit. This field varying in synchronism with the alternating character of the supply, cuts all wires in its immediate vicinity, inducing a voltage on them.

Electromagnetic induction differs from electrostatic in that it builds up in proportion to the length of the exposure, i. e., it acts along the wires. This should not be interpreted to mean that the *effect* of electrostatic induction is not also proportional to the length of the parallel, for it is. The difference in building up a voltage on the exposed telephone circuits is offset by other factors that make the net result the same.

It is impossible to say definitely which of these two types of induction predominate, this depending, of course, upon the relative magnitude of the current and voltages under consideration. In general, however, the electrostatic effect is the more serious.

The Two Effects of Induction

Whereas we have two separate causes of induction, we also have two different effects. Either or both of these effects may be realized from the same cause. These effects are arbitrarily designated as "longitudinal" and "transverse" induction. They are defined as:

Longitudinal Induction—The voltage induced on telephone conductors to ground (electrostatic) or the voltage induced along the conductors (electromagnetic).

Transverse Induction—The difference between the voltage induced on the two wires of a telephone circuit to ground (electrostatic) and the difference of induced voltage along the two telephone conductors (electromagnetic).

Example of Complete Longitudnal and Transverse Unbalance

An understanding of the difference between these two effects is easily had by a consideration of the following three examples: Case No. 1 as shown in Fig. 1, illustrates a maximum unbalance for both effects. This condition exists where there are no transpositions in either line. In this case there is induced in each of the telephone lines wires a voltage of the same instantaneous polarity but differing in magnitude, the greater voltage being induced on the telephone wire nearest the power circuit. Obviously a noise current will circulate through the telephone terminal apparatus as a result of the difference of voltages on the two sides of the circuit.

Example of Transverse Balance but Longitudinal Unbalance

Let us next consider a parallel indentical with that in Case No. 1 except that the telephone line has a transpostion at its midpoint. It is apparent that we have now exposed both telephone wires equally to the power line and we will therefore have equal voltages of the same polarity built up on each wire (neglecting phase change and attenuation). The difference in voltage between the telephone wires and ground or along the two wires will in this case be zero, and there will be little or no tendency for noise currents to flow for this reason. We may therefore say that we have complete transverse balance. You will note that the telephone transposition has not reduced the magnitude of the voltage built up on the two telephone wires but has only balanced it so that it is the same on both sides of the circuit. If the telephone line is perfectly balanced to ground (capacity) and the resistance of each wire is the same, this "longitudinal" voltage will not create noise currents, but as it is very difficult to keep a telephone circuit perfectly balanced at all times, noise will usually result. A study of the simple figure in Case No. 2 will show that telephone transposition *does not* reduce longitudinal induction. In case No. 2 we have complete "transverse" balance but a total "longitudinal" unbalance.

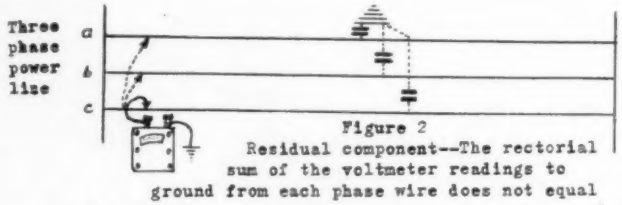


Figure 2
Residual component--The rectorial sum of the voltmeter readings to ground from each phase wire does not equal zone.

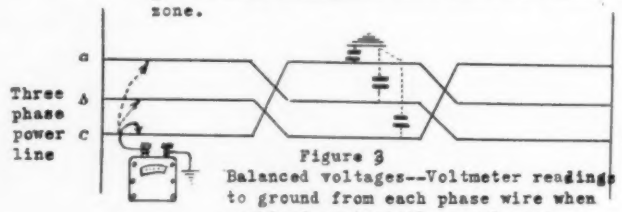
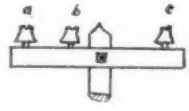


Figure 3
Balanced voltages--Voltmeter readings to ground from each phase wire when combined vectorially equal zone



Example of Both Transverse and Longitudinal Balance

In a third example (see case No. 3) we have placed a transposition at the midpoint of the power line and none in the telephone line. Here we see that the voltage induced in adjacent sections of the same telephone wire is theoretically reduced to zero. Also that the difference of voltage between the two wires is zero. In this case we have perfect balance and as a consequence minimum power noise interference. In most of the regular transposition schemes used by telephone companies for the transposing of circuits against cross talk and power noise, the transverse balance is obtained by means of telephone transpositions and longitudinal balance by power transpositions, i. e., but seldom are power transpositions utilized to furnish transverse balance. Case No. 4 illustrates the basic scheme of all co-ordinated transposition schemes between power and telephone lines.*

Transposition Theory

The general theory of transpositions is relatively simple and need only be mentioned. By "transposition" is meant the interchange of the relative position of wires on the same pole line. There are two classes of transpositions known as telephone and power transpositions. In telephone lines there are also two different types known as physical and phantom. The phantom transpositions are made by interchanging the pin positions of the pairs making up the phantom group.

Transpositions placed in a power line tend to equalize the capacitance of each phase wire to ground, and to cause the effect from balanced voltages and currents to neutralize or cancel out in adjacent section of paralleling telephone circuits.

When placed in telephone lines, they help to equalize the capacitance of the several conductors to ground, also to prevent cross talk between telephone circuits and tend to balance the induced voltage on each wire of a circuit exposed to paralleling power lines. I again wish to point out that telephone transpositions reduce the transverse induced voltages only, while power transpositions reduce both transverse and longitudinal induction (from balanced components).

Balanced and Residual Power Components

In order to explain further what can be expected from transpositions it is necessary to first define and consider the two components of current and voltage that are usually present in every power

circuit. These components are known as the "balanced" and the "residual" currents and voltages. The balanced current and voltages are those components that are completely balanced with respect to ground, i. e., their algebraic sum in the several phase wires is, at any instant, zero. This component represents the useful or necessary power carrying part.

The residual voltages and currents are those components completely unbalanced with respect to the earth, i. e., that flow through the line wires as one side and the earth as the other side of a circuit. Figures 2 and 3 illustrate the difference between the two components.

Residuals serve no useful purpose and anything that will reduce them to a minimum is highly desirable. The remedies for the reduction of induction into telephone lines from balanced and residual sources are fundamentally different and a thorough knowledge of each of these components is therefore essential.

Both balanced and residual components contain harmonics; however, residuals contain the larger percentage and therefore, for an equal voltage or current, create a greater disturbance in paralleling telephone circuits. The relatively larger inductive loop (earth and wires) of residuals also tends to make them more severe. In one specific case in California, it was found that one ampere residual current gave as much noise as 240 amperes balanced current. This was on a 22,000-volt parallel 17 miles long.

Residual Causes and Remedies

Residuals are set up in power lines by any one or combination of the following causes:

1. Difference in the capacity of the power wires to earth.
2. Direct leakage to earth via trees, insulators, etc.
3. Transformer connections and arrangements.

The remedies for their reduction are: No. 1—The proper transposition of the power lines, so as to place each wire in all of the conductor positions for the same distance. No. 2—As a rule little trouble is experienced from direct leakage, although (especially on arcing grounds) when direct leaks do occur their effect on the telephone line is very severe. No. 3—Care should be exercised by the power companies in keeping the loads in the respective phases balanced as nearly as possible, where unbalances might give rise to residual currents and voltages. This is especially true where star connected transformers with neutrals grounded are employed to feed lines in which the receiving transformers are likewise connected. The best transformer arrangement seems to be Delta-Delta. A very bad offender from a residual voltage standpoint is the practice of connecting single phase power line extension onto three phase feeder lines without an isolating transformer. A connection of this type sets up a residual voltage on the single phase line of approximately one-half of the voltage of the supply line. Figs. 4 and 5 illustrate the two general methods of extending a single phase line from a three phase feeder line.

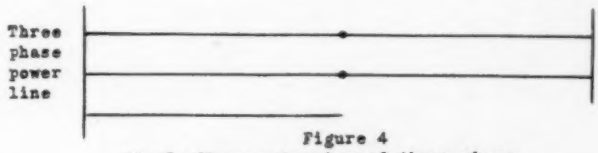


Figure 4
Single Phase extension of three phase line without isolating transformer.

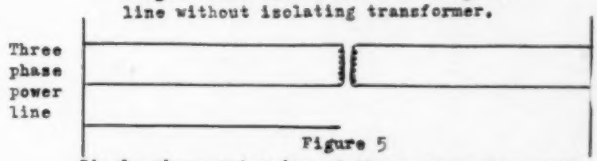


Figure 5
Single phase extension of three phase line with isolating transformer. This method should always be used on account of bad residual effects of direct extension.

Phase Relations with Different Combinations of Transpositions

Going back to transpositions, we find that certain fixed phase relations exist with different classes and combinations of transpositions. The following table shows this relation, giving the degrees phase change of the voltage induced in telephone circuits from power circuits, with various arrangements:

You will note in the above table that neither power or telephone transpositions are effective in transposing against longitudinal induction from residual components in the power line.

Inductive Coordination

The term "inductive coordination" as generally used, refers to the relative arrangement of transpositions in the power and telephone lines, where they are so located with reference to each other so as to result in minimum induction.

If the full measure of immunity is to be obtained in power and telephone line parallels, it is absolutely necessary that the transpositions in each line be coordinated. The importance of obtaining this relative location of transpositions can be appreciated best when it is realized that inductive noises in telephone lines may be greater with uncoordinated transpositions in both lines than when the transpositions in either of the lines are completely removed.

Inductive coordination also implies the proper operating and maintenance methods of both parties, so as to limit the inductive influence of power circuits and the inductive susceptiveness of telephone circuits. Coordination of transpositions in parallels is usually desirable on all new or proposed power line construction. It is, however, not always possible to attain complete coordination without considerable expense, which the circumstances may not seem to warrant.

The early transposition schemes used on telephone leads were designed to be effective principally in reducing crosstalk between telephone circuits. Of recent years, however, the expansion of the power industry into the rural sections, together with the increasing use of high voltage interconnected feeders between towns have made coordinated transposition schemes imperative in some cases and desirable in all. In order to meet this situation the American Tel. and Tel. Co. designed a system of tranpositions known as the "Exposed Line" system, which would provide both a crosstalk between telephone circuits and a balance to paralleling power circuits. These new sections differed from the old "Standard" sections, principally in that every circuit on the lead would be transposed to outside exposure more frequently, and that points would be pro-

PHASE CHANGE IN A TELEPHONE CIRCUIT FROM VARIOUS TRANSPOSITION CHANGES IN BOTH POWER AND TELEPHONE CIRCUITS

Class of circuit.	Power component.	Type of induction.	Phase change due. Tel. tran.	Pow. tran.
Single phase	Balanced	Longitudinal	0°	180°
Single phase	Balanced	Transverse	180°	180°
Single phase	Residual	Longitudinal	0°	0°
Single phase	Residual	Transverse	180°	0°
Three phase	Balanced	Longitudinal	0°	120°
Three phase	Balanced	Transverse	180°	120°
Three phase	Residual	Longitudinal	0°	0°
Three phase	Residual	Transverse	180°	0°

vided in the sections (full length section 8 miles) at which all circuits would be balanced to outside untransposed circuits. The purpose of these neutral points being to permit of discontinuities in the power lines such as load taps, feeder taps, transpositions, crossovers, etc., occurring without effecting the balance of the line. The older transposition schemes had no such neutral points, which explains why coordination for all circuits is not possible with these sections.

Transposition Design for Specific Parallels

The elementary principles of obtaining complete coordination or balance was explained in the forepart of this article. In an actual parallel, however, the obtaining of a balance is a much more difficult job than would appear from the elementary sketches showing power and telephone lines balanced to each other.

The number of circuits carried on telephone leads make necessary frequent transpositions in order to reduce crosstalk to a negligible value. The exposed line system of the A. T. & T. Co. shown in Fig. 6 illustrates the transpositions required in an 8 mile section with one arm of wire. This section, which as previously explained is designed especially for power parallels, and is so arranged that complete transverse balance to outside untransposed circuits exists in each eighth part of a full section. To obtain complete coordination with this type of section it is only necessary to arrange the power barrels so that they are complete within the parallel, and so that transposition points in the power line fall at the eighth points of the transposition section. It is also necessary that load taps and other discontinuities fall at the eighth points for complete balance. Barrels are usually three to six miles in length for balancing to full length (8 mile) telephone transposition schemes, and for single phase lines barrels of 2, 4, 6, or 8 miles may be used for balancing to full length exposed line sections.

In those cases where telephone lines are transposed to the older schemes such as the "Standard" or the older A B C sections and it is desired to maintain these sections without retransposition even though a power parallel is proposed, two courses are open. The first course is to lay out the power transpositions so that they fall at the points at which all telephone circuits on the lead in question most nearly balance transversely. In some cases it may be found desirable to depend upon power transpositions in obtaining or helping obtain transverse balance (see case No. 3), although it is usually preferable to obtain transverse balance solely by telephone transpositions.

When a power parallel of a telephone lead is proposed where the existing transposition scheme is other than one of the "Exposed Line" schemes, the question arises as to where to place the transpositions in the power line. One method that is convenient in determining this is to plot the telephone and power line to the same scale on paper and compute the equivalent untransposed lengths for various length power barrels. Fig. 7 illustrates the method suggested. For single phase lines the computation is very simple as the relation is a 180 deg. one which makes it only necessary to add or subtract depending upon the phase position. With three-phase lines, however, it is more complicated, requiring the algebraic combination of the various phase angles of each separate section. The chart shown in Fig. 8 is very convenient for adding the induction in the various sections and then combining by means of the formula shown to obtain the equivalent untransposed length of the different circuits on the telephone lead.

When complete coordination (usually the case) connot be obtained but satisfactory freedom from induction is obtained, it is well to plan to retranspose the lead to an exposed line scheme when major repairs on the wire lead are necessary.

The second method mentioned, in laying out power transpositions for a proposed parallel, is to place them so that they will coordinate with an exposed line transposition scheme, which can be placed at some later date if needed. If the proposed parallel is unusually long or of a voltage in excess of 22,000 volts, it is best to compute as previously explained the equivalent untransposed lengths of the various circuits involved, and if this is found to be large, immediate transposition to the "exposed line" section will probably be necessary in order to avoid temporary impairment of

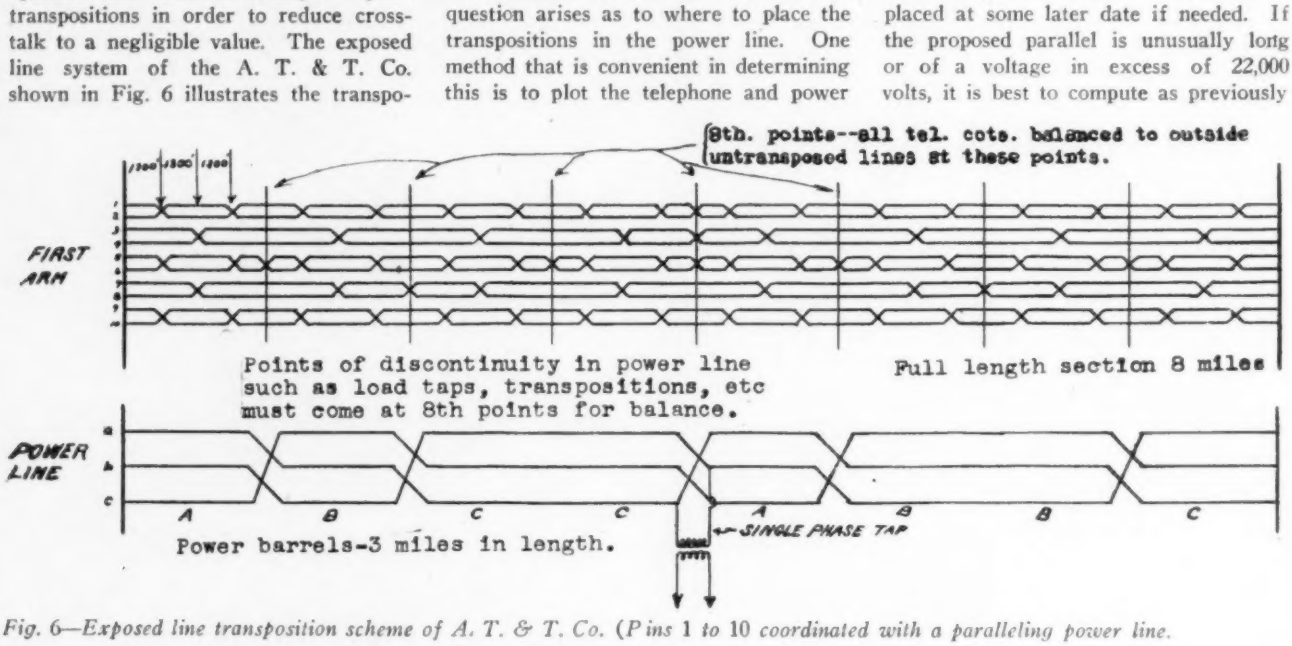


Fig. 6—Exposed line transposition scheme of A. T. & T. Co. (Pins 1 to 10 coordinated with a paralleling power line.

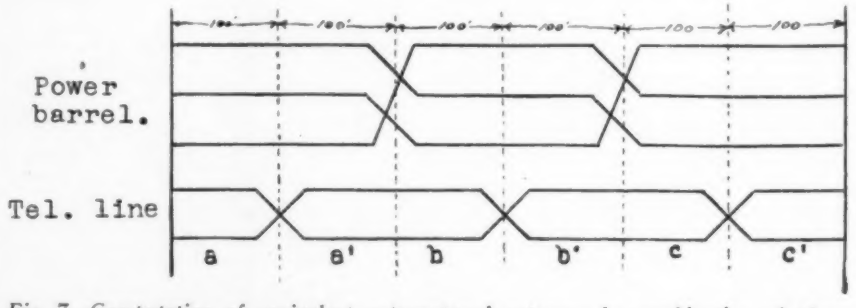


Fig. 7—Computation of equivalent untransposed exposure by combination of phase changes in different portions of the telephone line.

Equivalent untransposed lengths

Type of induction	Power component	Length of untransposed exposure
Longitudinal	Residual	a+b+c+a′+b′+c′
Longitudinal	Balanced	(a+a)/0°+(b+b′)/120°+(c+c′)/240°
Transverse	Residual	(a+b+c)—(a′+b′+c′)
Transverse	Balanced	(a—a′)/0°+(b—b′)/120°+(c—c′)/240°

service due to excessive induction.

The following table illustrates the phase relations of the residual and balanced components for single and three-phase lines and the formulas for computation of unbalanced exposures. Combination of the various lengths according to its phase position results in what is known as the "equivalent untransposed length," i. e., the length of untransposed telephone and power circuit which would give an effect equivalent to that of the parallel computed.

While it is not generally practical to convert unbalanced exposure or equivalent untransposed lengths directly into noise units for given parallels, yet this computation is useful in judging expected induction inasmuch as "equivalent untransposed lengths" result in something that can be visualized and compared with exposures of various lengths which are completely untransposed and on which the noise has been observed.

Power Barreling

In previous paragraphs I have referred to power barreling. A power barrel is defined as a section in which all wires of the power line occupy all of the different conductor pin positions for the same length. Their purpose is to obtain longitudinal balance as explained in the forepart of this article.

There are three types of barreling for three-phase lines which are known as:

Continuous barreling is produced by placing transpositions in the power line at equidistant points, and revolving the direction of transpositions always in the same direction, i. e., either left over right or right over left.

Halting barreling is produced by omitting every third transposition and revolving all transpositions in the same direction.

Halting reversing barreling is produced by omitting every third transposition and reversing the direction of transpositions in alternate barrels, i. e., if transpositions are thrown left over right in the first barrel then they should be right over left in the second barrel, etc.

Continuous barreling is seldom used

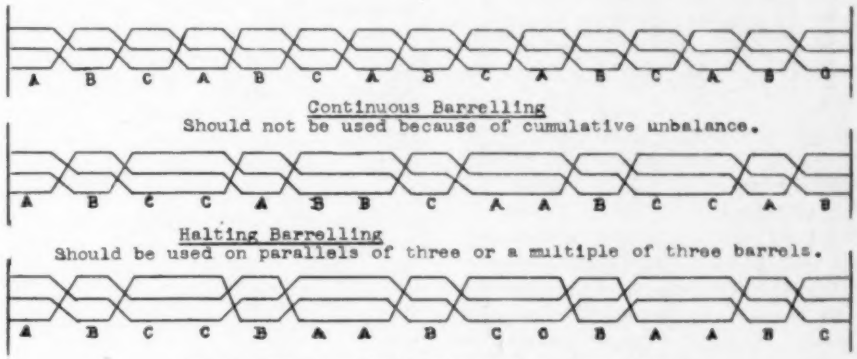

A B C A B C A B C A B C A B C
Continuous Barrelling
Should not be used because of cumulative unbalance.
A B C C A B B C A A B C C A B
Halting Barrelling
Should be used on parallels of three or a multiple of three barrels.
A B C C B A A B C C B A A B C

Fig. 9—Three methods of barrelling power lines.

Continuous—Halting—Halting Reversing

as the unbalances of successive barrels (due to phase change, etc.) add nearly in common phase. Halting barreling should be used on parallels of such length as to require three or some multiple of three barrels, as the unbalances of successive barrels are 120 degrees out of phase and will cancel out in each three barrel lengths. Halting-reversing barreling can best be used on parallels where there are two or some multiple of two barrels, for with this type of barreling, the unbalances in successive barrels is 180 degrees out of phase and will cancel out in two or some multiple of two barrels.

The effectiveness of power barrels decreases rapidly with length. With the high voltage lines (above 13,000 volts) barrels of from three to six miles are considered best practice, while with the lower voltage lines it is sometimes found advisable to transpose more often, especially where longitudinal balance is required in comparatively short sections because of discontinuities such as road crossings, taps, etc.

A crossover, i. e., a point where the telephone and power wires jump to opposite roadsides, causes a change in the inductive relations between power and telephone lines and should be avoided if possible.

Both longitudinal and transverse induction is changed by reason of the crossover. It is possible to rearrange the power wires (3 phase) so as to obtain a 0°, 120°, or 240° change in longitudinal induction before and after the crossover.

These crossing transpositions are sometimes useful in obtaining longitudinal balance.

Fig. 8—Computation of equivalent untransposed exposure for parallels with three phase power lines.

Cot. No.----- Zl Cct shown in Fig 7

	a	a′	b	b′	c	c′
Total	100′	+100′ −100′ 200′	100′	+100′ −100′ 200′	100′	+100′ −100′ 200′
Long *						
Trans *		0		0		0

Transverse unbalanced exposure due to the residual componept in the power line.

Formula-- a+b+c-(a′+b′+c′)= U

U = 0+0+0-(0+0+0)

U = 0

Transverse and Longitudinal unbalanced exposure due to the balanced components.

Trans.	formula	Long.
0	B	200
0	C	200
0	B+C	400
0	A	200
0	−½(B+C)	−200
0	x·A −½(B+C)	0
0	B-C	0
0	y = .866 (B-C)	0
0	U = √(x²+y²)	0

Note—A, B and C represent the result obtained from the algebraic addition of a and a′, b and b′ and c′ and c respectively. U = the equivalent untransposed length for the type of induction under consideration.

*The Longitudinal total is obtained by the straight arithmetical addition of a plus a′, b and b′, and c and c′ respectively. The transverse total is obtained by algebraic addition of a and a′, b and b′ and c and c′.

The transverse induction into a telephone line before and after a crossover is 180° plus the change in longitudinal induction.

If crossover transpositions are used to obtain longitudinal balance, the telephone conductors should be independently balanced against transverse induction at the point of crossover.

It should be noted that an ordinary power transposition changes the phase of the induction 120 deg assuming a cyclic shifting of the three wires. If the direction of rotation be reversed the direction of change of phase is also reversed.

From the slender description of the general theory and some of the practices given herein, it should be evident that the correct solution of the "inductive interference" problem in any specific case will only be had, where mutual cooperation and understanding exist between both power and communication companies. For one company the problem is one for the reduction of the "inductive influence" of their circuits, and for the other a reduction in the inductive susceptiveness," but most assuredly a mutual problem mutual in all its aspects.

I. T. & T. to Purchase Argentine Phone Co.

New York.—J. P. Morgan & Company and the National City Company are heading a syndicate which in behalf of the International Telephone and Telegraph Corporation has made an offer of shares and cash to the stockholders of the United River Plate Telephone Company, an English enterprise and one of the largest operating in South America. Formal announcement to this effect was made by the I. T. and T. tonight. The United River Plate Telephone Company owns and operates the largest telephone system in Buenos Aires and four provinces of the Argentine, serving more than 185,000 telephone subscribers.

The United River Plate Company has a paid-up capital of about £5,000,000 or approximately $25,000,000. Reports from London earlier this year indicated that I. T. and T. would pay around $35,000,000 for the acquisition of the systems, which is in territory where I. T. and T. in the last few years has been extending rapidly.

The announcement said the shareholders of the United River Plate Company are being offered an exchange of one-fifth of a share of I. T. and T. stock plus £4 10s, or £12 cash for each share of the stock. Directors of the River Plate company have recommended to stockholders that they accept this offer and deposit their stock for exchange on or before January 3.

Foreign Countries Linked by Telephone Service in New Chain

The International Telephone and Telegraph Corporation announce that telephone service between Valparaiso, Chile, and Buenos Aires, Argentine, was successfully inaugurated on November 15th. The Intendente, or Governor of the Province of Aconcagua, Chile, opened the service speaking with the Chilean Charge d'Affaires in Buenos Aires.

This service is an extension of the trans-Andine telephone service between Buenos Aires and Santiago recently established by the Compania Telefonica Argentina and the Chile Telephone Company, both associated companies of the International Telephone and Telegraph Corporation.

Telephone service between Spain and Cuba was officially inaugurated today, according to an announcement by H. B. Orde, Acting Executive Vice-President of the International Telephone and Telegraph Corporation of 67 Broad Street.

The Cuban Telephone Company and the Compania Telefonica Nacional de Espana which inaugurated this service are both associated companies of the International Telephone and Telegraph Corporation.

The International Telephone and Telegraph Corporation announces that a new rotary automatic telephone system was successfully inaugurated in Valencia, Spain, on November 10th, by its associated company, Compania Telefonica Nacional de Espana.

The first modern telephone exchange ever installed in the northwestern part of Africa was successfully put into service in the city of Ceuta on November 16th by the Compania Telefonica Nacional de Espana, an associated company of the International Telephone and Telegraph Corporation, according to cablegraphic advices which have just been received by the latter corporation.

This new installation gives to Spain's possessions in northwestern Africa, greatly improved facilities for telephonic communication with the mother country by way of the deep-sea telephone cable which was laid under the Straits of Gibraltar between Algeciras and Ceuta by the Compania Telefonica Nacional de Espana in the latter part of 1924 and which at that time, was widely acclaimed as the first telephone link joining the continents of Europe and Africa.

New York Commission Approves $12.00 Switching Fee

In the case of Barrington and Wayne Telephone Company, et al., vs. Dundee Telephone and Telegraph Company the Public Service Commission of New York upheld the action of the telephone company in increasing the charge for switching service from $5.00 to $12.00 per station per year. The court held that the company had given ample proof to show that the cost of rendering switching line service was at least $12.00 per station per year. The Barrington and Wayne and three other telephone companies filed the complaint. The four switching line companies complained that the switching rate charged by the Dundee Company was exorbitant, unfair and unwarranted. The testimony showed that complainants switched 270 stations; that the switching line companies owned their telephone instruments and lines up to the terminal boxes at the ends of the aerial cable of the Dundee Company and that switching line subscribers had the same free calling area as Dundee subscribers.

A. T. & T. Earnings Gain

The American Telephone and Telegraph Company is expected to show about $12 a share earned this year on 11,491,476 average outstanding shares, compared with $11.76 a share in 1927 on 10,930,420 average outstanding shares. This is significant of the great strides made by the company in increasing its business because the company has reduced its long distance toll rates substantially. To make up for this rate reduction there has evidently been a heavy increase in business. The demand for A. T. and T. shares on the Stock Exchange indicates that the investment public is aware of the company's excellent earnings position. On several days in the last week the price jumped upward sharply and closed the week at 200. This is only 11 points below the year's high, which was made before the stock went ex-rights.

Badger 'Phone Co. Purchased

The Badger Telephone Co. of Oconomowoc, Wis., which has been serving about seven hundred and fifty subscribers in the townships of Oconomowoc and Merton in Wau-Kesha Co., Ixonia in Jefferson Co., Ashippun and Lebanon in Dodge Co. and Hartford and Erin in Washington Co. has been sold to W. N. Albertson & Co.

The new owner will operate this company in connection with the following local companies, which have recently been purchased by them: Jackson Telephone Company, Allenton, Kohlsville Telephone Co., Merton Telephone Co., and the Washington County Telephone Co. of Slinger, having their branch office in Milwaukee and general offices at Omaha, Neb.

Practical Suggestions for Plant Valuation

By CHARLES W. McKAY, M. E.*

In the November issue the subject of real estate valuation was discussed in some detail.

Now we come to the subject of the appraisement of buildings, Account 212. Similar to the evaluation of land, most courts and commissions have ruled that buildings should be appraised by architects or contractors—preferably the architects or contractors who have been identified with the erection of the original structures.

However, when it comes to telephone buildings the telephone engineer is usually well qualified to do work of this kind himself. Like electric light and power central stations and sub-stations, telephone buildings must, of a necessity, be widely different from buildings used for ordinary commercial and industrial purposes. In other words, telephone buildings are designed for an especial purpose; certain peculiar costs are involved and the telephone engineer is usually far better equipped to take into account these factors than the ordinary architect or building contractor.

Even if the building is appraised by an architect or a contractor all figures should be checked over by the telephone valuation engineer before they are submitted to a court or commission in connection with a rate case or for any other purpose, such as refinancing, purchase and sale cases, etc.

This "check" may often be effected by an engineer who knows his business, by using a unit cost per cubic foot of building contents or, in some cases, a unit cost per square foot of floor area.

Appraisement of Central Office Telephone Equipment, Account 221.—The unit costs used in central office equipment are so largely dependent upon the exigencies of individual cases that it is practically out of the question to give any specific data.

As a general rule it may be said that the appraisement of telephone switchboards, frames and racks can be best effected by ascertaining the manufacturer's name, and the type, ultimate capacity and present equipment of the apparatus in question, referring directly to the manufacture for prices as of the appraisal date. These prices may subsequently be modified if, in the appraiser's judgment, they are unduly high due to some peculiar condition in the material or labor markets at the time of the appraisal.

*Consulting Telephone Engineer, 192 N. Clark street, Chicago.

Other Equipment of Central Offices, Account 222.—This account, it will be remembered, includes all furniture and equipment other than telephone equipment, in the central office operating, retiring and lunch rooms, etc. A large part of this equipment consists simply of ordinary furniture, such as chairs, tables, etc., and prices can be readily obtained from the appraiser's files, or from local dealers in equipment of the type under consideration.

Appraisal of Station Apparatus, Account 231.—The appraisal of the station apparatus, or subscribers' station instruments, should be prefaced by a careful review of telephone instrument prices as of the date of appraisal and for the several years preceding the appraisal. To conform with the Interstate Commerce Commission's accounting instructions, only the price of the instrument should be included under the 231 account. All additional material and labor costs incurred in the installation of the instrument will be appraised under Station Installations, Account 232.

In cases where it is impossible to segregate various types of instruments, i. e. wall, desk, etc., in the process of taking inventory, an allowance should be made in building up the unit cost per instrument for the fact that the instruments are probably not of one type. For instance, if after consultation with the plant authorities it is found reasonable to assume that 75 per cent of the instruments are of the hotel wall type, 15 per cent of the desk type, and 10 per cent of the long-back wall type, the unit cost should be correspondingly weighted.

Stations Installations, Account 232.—The Station Installation Account, it will be recalled, covers the cost of all material and labor used in placing the telephone instrument on the subscriber's premises. To quote the Interstate Commerce Commission:

"This account should include the cost of installing station apparatus and the cost of inside wires; that is, the wires (or cables) from the instruments to the point of entrance to the building, where the drop wires or interior block wires terminate; or to the junction boxes, where the house cable or other cable terminates, including wires on the same premises to connect main and extension stations; or to connect the private branch exchange distributing frames with their terminal stations."

The following is an illustration of the computation of an installation unit cost as taken from a recent telephone appraisal:

1 fuse, at ..... cents.....	....
16 feet inside wire, at .... a foot	....
10 feet duplex bridle wire, at .... a foot	....
2 porcelain knobs, at .... each..	....
6 Perfection nails, at .... each..	....
8 screws, at .... each.....	....
Total material	....
Total material plus 2 per cent for waste and loss, labor of installing	....
Total installation cost per station	....

Interior Block Wires, Account 233.—The determination of the unit costs for interior block wiring is rather a difficult problem. It may be effected either by arriving at a cost per foot placed of wiring along rear building walls and fences, or by estimating a cost per station fed by interior block wiring.

In either case the unit costs should be derived by going over a number of work orders and determining the average span length of block wire and the average number of rings, etc., used in installation. In the same way an estimate may be made of the length of time necessary for installing a block wire of average length.

The unit costs should be derived in a manner similar to the one outlined in the preceding paragraph, under the heading "Station Installations."

Private Branch Exchanges, Account 234.—The private branch exchange account, it will be remembered, includes the cost of the switchboards, their distributing frames, the cables connecting such switchboards and distributing frames, and the cost of installation.

Unit costs for this type of equipment can best be arrived at by ascertaining from the manufacturer of the equipment in question the prices prevalent as of the appraisal date, and making suitable additions for cost of installation.

Booths and Special Fittings, Account 235.—The Interstate Commerce Commission's accounting instructions specify that under account 235 shall be included the cost of booths and special fittings, such as desks, chairs, fans, cash registers, together with their respective installation costs.

It is hardly necessary to outline a specific method for arriving at the unit costs of equipment of this nature. It is only

necessary to refer to manufacturers' catalogues and obtain reasonable material prices, and make suitable additions to cover the probable installation costs.

The Pole Line Appraisal.—The pole account, it will be remembered, includes poles, cross arms, steps, brackets, anchors and guys. Needless to say, it is necessary to derive separate unit costs for each of these items. With the exception of the poles themselves and the cross arms, it is usually a comparatively simple matter to determine the unit costs as used for appraising the property falling under accounts 241 and 251.

The unit costs will usually be about the same for both exchange and toll equipment, with the possible exception that the toll units will run a little higher than the exchange units, due to the increased costs of doing work at a distance from the base of supplies. In other words, due to the fact that the major portion of a toll line is necessarily located on rural highways, the cost of hauling material to the job will be greater than in the case of exchange pole line construction. The fact that it is frequently necessary for the company to board the men increases the labor item.

Pole Unit Costs.—The first step in preparing the pole unit costs is the determination of material prices, not only as of the appraisal date, but also for a period of several years preceding the appraisal. These prices should be determined by getting quotations from a number of competent concerns and tabulating the results somewhat in the manner shown in Fig. 1. This table is taken from a recent appraisal, and it happens that all of the prices were taken from the same source—the quotations of the Western Electric Company.

UNIT COSTS FOR POLE LINES

Height (Feet)	Top (Ins.)	Quotation No. 1	Quotation No. 2	Quotation No. 3	Average
20	4	.....	.....	.....	.....
.....	5	.....	.....	.....	.....
.....	6	.....	.....	.....	.....
25	4	.....	.....	.....	.....
.....	5	.....	.....	.....	.....
.....	6	.....	.....	.....	.....
.....	7	.....	.....	.....	.....
.....	8	.....	.....	.....	.....
30	4	.....	.....	.....	.....
.....	5	.....	.....	.....	.....
.....	6	.....	.....	.....	.....
.....	7	.....	.....	.....	.....
.....	8	.....	.....	.....	.....
.....	9	.....	.....	.....	.....
35	5	.....	.....	.....	.....
.....	6	.....	.....	.....	.....
.....	7	.....	.....	.....	.....
.....	8	.....	.....	.....	.....
.....	9	.....	.....	.....	.....
40	6	.....	.....	.....	.....
.....	7	.....	.....	.....	.....
.....	8	.....	.....	.....	.....
.....	**9**	.....	.....	.....	.....
45	6	.....	.....	.....	.....
.....	7	.....	.....	.....	.....
.....	8	.....	.....	.....	.....
50	7	.....	.....	.....	.....
.....	8	.....	.....	.....	.....
.....	9	.....	.....	.....	.....
55	8	.....	.....	.....	.....
60	7	.....	.....	.....	.....
.....	**8**	.....	.....	.....	.....
.....	**9**	.....	.....	.....	.....
15	4	.....	.....	.....	.....
.....	5	.....	.....	.....	.....
10	2x4	.....	.....	.....	.....

Fig. 1—Material prices for western and northern cedar poles

The next step involves the determination of proper labor units. Fig 2 shows a rather comprehensive analysis of the various labor costs of poles entering into the preparation for use in a telephone property.

It will be noted that in Fig. 2 only direct supervision is provided for. Direct supervision, in this case, consists of a proportionate allowance of the wages of the construction foreman, who directs, and who sometimes actually participates in, the work. All of the general supervision, or overhead charges, as they are sometimes called, is cared for under the collateral construction costs, as we have already seen in a previous chapter.

Preliminary to the preparation of Fig. 2, it is necessary, of course, to ascertain the prevalent labor rates in the community in which the plant under consideration is located, and to further ascertain whether or not the scale of wages in force at the date of appraisal is of average conditions.

Fig. 3 is in the nature of a summary for the material and labor units determined in Figs. 1 and 2. It will be noted that in the fourth column of Fig. 3, an allowance of 2 per cent of the cost of the pole is made for waste and loss.

This allowance is customary for all of the material used in outside plant construction. Its purpose will be apparent when it is remembered that a certain proportion of the material received on the job for construction purposes is always found to be defective, and, in the case of smaller articles, a certain proportion is usually lost or stolen. Experience has proved that 2 per cent is a fair average allowance for this item of loss and waste.

The last column of Fig. 3 shows the unit costs in completed form, ready for use in the appraisement. In this connection it should be noted that the labor figures as given in Fig. 3 do not agree with those quoted in Fig. 2. The tables are merely for illustration purposes and not for use in actual appraisal work.

Cost of Painting Poles.—In Fig. 4 is presented an analysis of the cost of painting poles. Of course this cost for poles of a given height will vary somewhat according to the diameter. The costs given in the table are average prices, and based largely upon the sizes of poles most frequently used—4-inch, 20-foot; 5-inch, 25-foot; 6-inch, 30-foot, etc.

Size (Feet)	Material	Labor	Cost
20	.....	.....	.....
25	.....	.....	.....
30	.....	.....	.....
35	.....	.....	.....
40	.....	.....	.....
45	.....	.....	.....
50	.....	.....	.....
55	.....	.....	.....
60	.....	.....	.....

Fig. 4.—Cost of Painting Poles.

Cross Arm Unit Costs.—The first step in the determination of the cross arms unit costs is to tabulate all of the data as to cross arm prices at the date of the appraisal and for the several years preceding the appraisal, in much the same form as that suggested for poles in Fig. 1. Having determined the material prices,

the unit costs will be built up in somewhat the following manner:

1 ten-pin standard 120-inch fir cross arm, at $....	....
10 1¼-inch by 8-inch locust pins at $....	....
10 16-d. nails at $....	....
2 22-inch cross arm braces, at $....	....
2 ⅜-inch by 4-inch carriage bolts at $....	....
1 ½-inch by 4-inch fetter-drive screw at $....	....
2 1¼-inch washers at $....	....
1 ⅝-inch by 12-inch machine bolt at $....	....
2 2¼-inch washers at $....	....
Total material	....
Waste and loss at 2 per cent	....
Total material, including waste and loss	....
Cost of placing cross arm	....
Unit cost	....

As previously suggested, the labor item will be raised slightly for use in the appraisal of the toll and rural plant.

Cost of Stepping.—In many plants only the terminal poles—i. e., poles on which aerial or underground cable terminals are located—are stepped. It is, therefore, usually advisable to determine a separate unit cost for stepping poles, and not to include the cost of stepping as a part of the pole unit costs. Fig. 5 shows the derivation of the unit cost for stepping poles of various sizes.

Unit Costs for Anchors and Guys.—In the discussion of the unit costs for the poles and cross arms, emphasis was laid upon the fact that all material and labor costs, as of the appraisal date and for the several years preceding the appraisal, should be carefully reviewed before the adoption of final figures for use in building up the unit costs. This is equally necessary in the case of the unit costs for the anchors and guys, and for all of the unit costs for outside plant construction treated hereinafter. If the reader will bear this suggestion in mind, it will not be necessary to refer to it specifically in the case of the individual unit costs.

All of the unit cost calculations given in the ensuing paragraphs are based on the premises that all material and labor costs used in building up the units have been subjected to careful analysis by the appraisal engineer. Figs. 6 and 7 show the method of building up unit costs for anchors and guys, respectively.

Height of pole (feet)	25	30	35	40	45	50	55	60	70
Number of iron steps	8	11	14	17	20	23	26	29	35
Number of wood steps	5	5	5	5	5	5	5	5	5
Material—									
Iron steps	..	..	..	..	..	..	..	..	..
Wood steps	..	..	..	..	..	..	..	..	..
Nails for wood steps	..	..	..	..	..	..	..	..	..
Waste and breakage	..	..	..	..	..	..	..	..	..
Total material	..	..	..	..	..	..	..	..	..
Labor—									
Boring for steps	..	..	..	..	..	..	..	..	..
Attaching steps	..	..	..	..	..	..	..	..	..
Supervision, 15 per cent	..	..	..	..	..	..	..	..	..
Total labor	..	..	..	..	..	..	..	..	..
Total cost	..	..	..	..	..	..	..	..	..

Fig. 5.—Cost of stepping poles.

	4	4½	5	5½	6	6½	7	8
20 foot—	....	....	....	....	....	....	....	....
Unloading	....	....	....	....	....	....	....	....
Roofing	....	....	....	....	....	....	....	....
Hauling	....	....	....	....	....	....	....	....
Digging	....	....	....	....	....	....	....	....
Setting	....	....	....	....	....	....	....	....
Supervision, 15 pct.	....	....	....	....	....	....	....	....
Total	....	....	....	....	....	....	....	....
25 foot—	....	....	....	....	....	....	....	....
Unloading	....	....	....	....	....	....	....	....
Roofing	....	....	....	....	....	....	....	....
Hauling	....	....	....	....	....	....	....	....
Digging	....	....	....	....	....	....	....	....
Setting	....	....	....	....	....	....	....	....
Supervision, 15 pct.	....	....	....	....	....	....	....	....
Total	....	....	....	....	....	....	....	....
30 foot—	....	....	....	....	....	....	....	....
Unloading	....	....	....	....	....	....	....	....
Roofing	....	....	....	....	....	....	....	....
Hauling	....	....	....	....	....	....	....	....
Digging	....	....	....	....	....	....	....	....
Setting	....	....	....	....	....	....	....	....
Supervision, 15 pct.	....	....	....	....	....	....	....	....
Total	....	....	....	....	....	....	....	....
35 foot—	....	....	....	....	....	....	....	....
Unloading	....	....	....	....	....	....	....	....
Roofing	....	....	....	....	....	....	....	....
Hauling	....	....	....	....	....	....	....	....
Digging	....	....	....	....	....	....	....	....
Setting	....	....	....	....	....	....	....	....
Supervision, 15 pct.	....	....	....	....	....	....	....	....
Total	....	....	....	....	....	....	....	....

Fig. 2—Labor costs of cedar poles in city, exclusive of painting, stepping, shaving and gaining

1 Patent anchor, 5-inch at $....	....
2 guy hooks at $....	....
1 Crosby clip at $....	....
1 2-bolt clamp at $....	....
10 pole shims at $....	....
1 ⅜-inch thimble at $....	....
2 fetter-drive screws, ½-inch by 4-inch, at $....	....
20-foot ⅜-inch S. & M. strand at $....	....
20-foot No. 6 B. B. iron wire at $....	....
Total	....
Add 2 per cent loss and waste	....
Total material	....
Labor, placing rod	....
Labor, placing guy	....
Field supervision and teaming	....
Total labor	....
Unit cost	....

Fig 6.—Unit cost of light patent anchor (rural).

75-foot 5/16-inch S. & M. strand at $....	....
50-foot ⅜-inch S. & M. strand at $....	....
2 guy hooks at $....	....

2 fetter-drive screws, ½-inch by 4-inch at $....	....
10 pole shims at $....	....
2 Crosby clips at $....	....
2 2-bolt clamps at $....	....
Total	....
Add 2 per cent loss and waste..	....
Total material	....
Labor, placing guy	....
Field supervision and teaming...	....
Total labor	....
Unit cost	....

Fig. 7.—Unit cost of head guys (city and rural).

In the February installment the subject of the derivation of the unit costs will be concluded. May I again emphasize the fact that too much care cannot be exercised in evolving the unit costs? In other words, an inventory may be taken with the utmost care, but it is practically valueless if the unit costs are not fair and conservative.

Consider a simple illustration. Suppose we take an inventory of all the furniture and fixtures in your office, counting every single item, and after we get through suppose we get a little careless and apply almost "any old unit cost" to the various items, such as swivel chairs, roll and flat top desks, stenographic desks, etc. Of what possible use would such an appraisal be?

Canadian Phone Outlay $27,000,000

Montreal.—The Bell Telephone Company of Canada will spend the record sum of $27,000,000 on construction and expansion of facilities during 1929, as compared with $22,000,000 in 1928 and $18,000,000 in 1927. Of the total, $7,000,000 will be spent on extending long-distance lines.

CITY

Height (Feet)	Top (Ins.)	Pole Cost	2 Per Cent Waste and Loss	Total Material	Total Labor	Cost Each
15	5	.....	.....	.....	.....	.....
20	4	.....	.....	.....	.....	.....
	5	.....	.....	.....	.....	.....
	6	.....	.....	.....	.....	.....
25	4	.....	.....	.....	.....	.....
	5	.....	.....	.....	.....	.....
	6	.....	.....	.....	.....	.....
	7	.....	.....	.....	.....	.....
	8	.....	.....	.....	.....	.....
30	5	.....	.....	.....	.....	.....
	6	.....	.....	.....	.....	.....
	7	.....	.....	.....	.....	.....
	8	.....	.....	.....	.....	.....
35	5	.....	.....	.....	.....	.....
	6	.....	.....	.....	.....	.....
	7	.....	.....	.....	.....	.....
	8	.....	.....	.....	.....	.....
40*	6	.....	.....	.....	.....	.....
	7	.....	.....	.....	.....	.....
	8	.....	.....	.....	.....	.....
45*	7	.....	.....	.....	.....	.....
	8	.....	.....	.....	.....	.....
50*	7	.....	.....	.....	.....	.....
	8	.....	.....	.....	.....	.....
55*	8	.....	.....	.....	.....	.....
60*	8	.....	.....	.....	.....	.....

RURAL AND TOLL

15	4	.....	.....	.....	.....	.....
20	4	.....	.....	.....	.....	.....
	5	.....	.....	.....	.....	.....
25	5	.....	.....	.....	.....	.....
	6	.....	.....	.....	.....	.....
	7	.....	.....	.....	.....	.....
30	6	.....	.....	.....	.....	.....
35	6	.....	.....	.....	.....	.....
	7	.....	.....	.....	.....	.....
	8	.....	.....	.....	.....	.....
40*	7	.....	.....	.....	.....	.....
10	2x4	.....	.....	.....	.....	.....

*Western cedar.

Fig. 3—Summary of material and labor costs for cedar poles.

CONVENTION SCHEDULE

South Dakota, Cataract Hotel, Sioux Falls, January 15-17.

Arkansas, Marion Hotel, Little Rock, January 21-22.

Minnesota, Hotel Lowry, St. Paul, January 22-24.

Oklahoma, Lee-Huckins Hotel, Oklahoma City, March 12-14.

Texas, Hotel Texas, Fort Worth, March 25-27.

Ohio, Deshler-Wallick Hotel, Columbus, April 16-18.

Indiana, Claypool Hotel, Indianapolis, May 7-9.

Extensive Improvements in Nebraska

Sutton, Nebr.—The extensive alteration and improvement program of the Lincoln Telephone and Telegraph Co. between Fairmont and Harvard, of which the Sutton exchange is a part, is getting well under way, and when completed will make this line as modern as any in the United States. New and heavier wires are being strung and every up to the minute appliance is being installed.

The line will be entirely rebuilt, and Manager Olson of the local exchange says that the new line will expedite business in every way. The construction program calls for every piece to be new. Two of the six cars of poles to be unloaded at Sutton are already being placed by the working crew. The poles are of the large size and have passed through a treatment of carbolinium under a high pressure from top to bottom. Besides making the pole longer lived it increases its weight about twice.

Liberal, Kans., Switchboard Enlarged

Liberal, Kan.—The Liberal Telephone Company has recently added one hundred new numbers to its switchboard, the increase being made necessary by Liberal's continued growth. For the past two years the population of the city has been steadily growing and Manager Jas. Thompson believes in keeping his equipment up to the needs of the city.

Buys Exchange at Keweenaw Bay

Hancock, Mich.—A. W. Stark, manager of the Baraga Telephone Company, on Saturday of last week purchased the Keweenaw Bay local from Mrs. R. M. Crebassa. With the buying of this line, the Baraga Telephone Company now controls all of the local telephones in Baraga township.

There were 55 subscribers in the Keweenaw Bay local, practically all of whom were located in the country. The purchase now gives the Baraga company 250 instruments in use.

A Telephone Friend Factory

By RAY BLAIN

Telephone companies have not always enjoyed the popularity that they do today in the eyes of the general public. There was a time in the not far distant past that they were considered just a necessary evil. We need not go back but a few years to reach that period when all public utilities were hated by the ayerage citizen. Let us consider for the moment the cause of this condition and what brought about the change from it, to the present popularity.

The railroads were perhaps the most despised of the lot with the lighting and telephone companies running a close second. In those days if you asked a question of a ticket agent or an attendant at a window with a large information sign over it, you would perhaps receive a curt, insolent answer. There was also among the trainmen many ill natured, bad tempered individuals that heaped indignities on the heads of the traveling public, that did much to foster the feeling of hatred.

The telephone during that period was not considered the necessity that it is today, neither was it as efficient. In many cases interruptions of service were all too frequent, and were not cleared with the dispatch that is present practice. Subscribers would request refunds to which they thought they were entitled for periods they were without service and in many cases their requests were ignored or there ensued a heated argument which resulted in the making of an enemy for the company.

Troublemen were in a habit of being careless and were not always particular about cleaning their feet in stormy weather before entering houses. I even knew of one case when a troubleman entered a house over oriental rugs and polished floors with his hooks on and became very indignant when the lady of the house asked him to please remove them.

Installers also were careless and drilled holes through floors and walls in any location that would make their tasks easier. I knew one who drilled a hole through a wall and a sliding door that was pushed back out of sight at the time. No special effort was made to locate lightning arresters out of sight and in many cases plaster was damaged by using the wrong kind of bits when drilling holes through walls. The company generally felt insulted if asked to conceal wiring even in the finest residence.

Not much if any effort was ever made to locate poles along streets and alleys to please property owners. Likewise it was in many cases considered quite a joke to trim, or rather butcher trees and run before being discovered by the owner.

In recent years the point of contact with the public has been recognized by all public utilities and their employees are taught to distribute a feeling of good will that does much to improve the standing of the various companies in the eyes of the average citizen. Nowadays if you ask information of any employee of a railroad they will make a real effort and go out of their way if necessary to give you a satisfactory answer. Trainmen also try to make you comfortable and have the interest of the traveler constantly in mind. With the railroads the newer modes of transportation and their competition might have something to do with their change of tactics, but the increased good will of the public for the telephone companies cannot be attributed to this cause as the condition is exactly the reverse. Competition in the telephone industry causes an increase in cost to the subscriber with an inferior grade of service. With the elimination of competition the subscribers have a much higher regard for the improved service and the company that furnishes it.

Much benefit has been derived from the education of the public in regard to the problems of the telephone company in furnishing service during storms, floods, etc. Nowadays if the subscriber has an interruption of service and requests a refund, his request is usually granted readily. However, in many cases—yes, I will say in most cases—when the subscriber realizes that the company is on the job making every effort to furnish service and that they will not permit a line to be out of service longer than can be avoided, they will not bother to ask for a small refund. With better materials and construction methods interruptions are rapidly growing fewer and of shorter duration.

The value of educating the subscriber was proved to me some time ago when we cut over a manual exchange to automatic. During the first rush of everyone trying out the new system subscribers tried to dial too fast which resulted in a large number of wrong number calls. We immediately started a system of instructing the subscribers in the proper method of using the dial and invited them all to visit the new exchange. Many accepted and we demonstrated the operation of the equipment and what happened when they did not dial properly. The net result was that our trouble was eliminated and they now swear by, instead of at us.

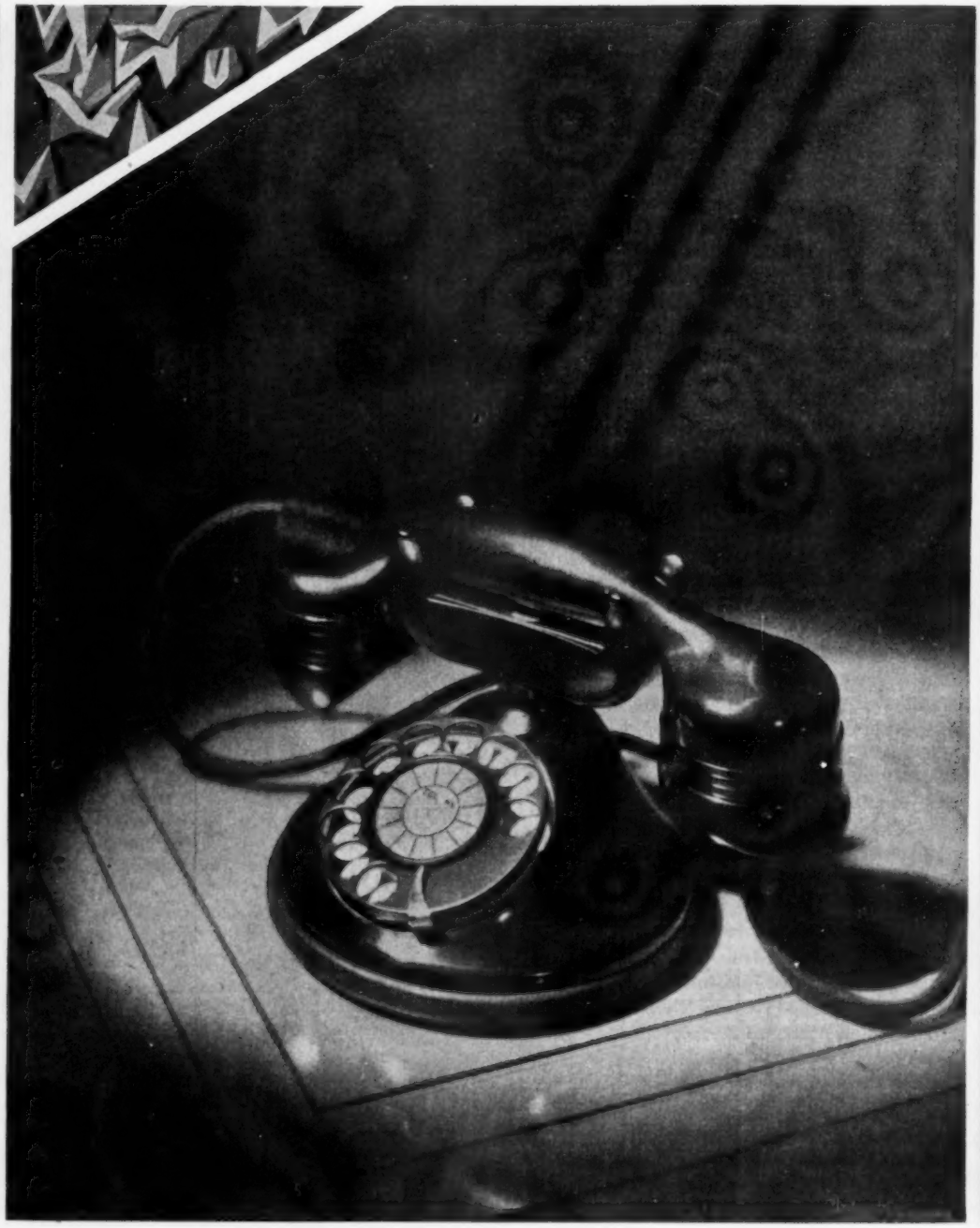
The operators are no longer considered gum chewing, novel reading idlers by the subscribers. This is due to the fact that they have most of them at some time visited an exchange and have seen for themselves that the operators are always busy and don't have any time to idle. There is no doubt but that the careful training of operators has done much to increase the subscribers' regard for the company. Of course many subscribers are at times impatient and unreasonable but it only makes matters worse for the operator to become impatient at the same time.

In the old days the repairmen and installers were in many cases slouchy, careless individuals in their dress and manners as well as their work. There was among them many of that type called "boomers" who would work on one exchange for a time and then move on to the next. These men did not have the interests of the company at heart and made no special effort to please subscribers which resulted in the making of many enemies.

With the changing times the "boomer" has passed from the telephone exchange forever and in his place comes a sensible type of man that usually takes a great interest in his work. These men are always clean and neat in dress and careful in their habits. They realize that they are representatives of the company and that by their actions the opinion of the company is moulded in the community. Installation of each phone is carefully planned before work is started. All wiring is concealed if necessary or desired and above all the subscriber must be pleased with the finished job. Modern construction of dwellings usually permits the drop wire entrance be made into the basement with the arrester out of sight and the house wire run up inside a partition to the instrument which conceals everything that might detract from the appearance of a room.

For years the telephone users have clamored for a "French type" phone as depicted by the movies. They wanted this type instrument as it was something different, pleasing in appearance and seemed convenient. The recent introduction of the "Monophone" seems to answer all these requirements and more, as it gives a much better average transmission than the old candlestick type.

I noticed recently at a Progress Exposition at Columbus, Ohio, that a large telephone company had on exhibition the push button control system which is very similar to the old No. 2 PBX. The system exhibited makes use of two trunk lines to the main exchange which are



The automatic desk stand Monophone, Type 1-A, is pictured in the accompanying illustration. Other equally attractive styles can be furnished for either automatic or manual operation, or, if desired, equipped with dial blanks for transition service.

STROWGER AUTO
TELEPHQUIPM

A Modern Telephone To Fit Modern Requirements

A TELEPHONE instrument today must be more than an excellent mechanism, capable of receiving and transmitting conversation with clarity and distinctness. It must conform to the modern trend. It must be compact and have pleasing, graceful lines. It must not only have all of the excellent operating characteristics of the older type telephones, but must have them in a convenient, easily-handled form, which has as a prime consideration the comfort and pleasure of the user.

That the Monophone conforms to these qualifications to a high degree is attested by its overwhelming popularity. There are now over 45,000 Monophones in service, and orders are being placed for them by telephone companies everywhere in ever-increasing quantities. The increased rental charged for its use seems to offer no deterrent to the demand, and provides an excellent source of additional income for the telephone company.

Automatic Electric Inc.

Factory and General Offices: 1033 W. Van Buren St., Chicago, U. S. A.

Sales and Service Offices in all Principal Cities

EXPORT DISTRIBUTORS

For Australasia—Automatic Telephones, Ltd., Sydney

For Canada—Independent Sales & Engineering Co., Ltd., Vancouver

Elsewhere—The Automatic Electric Company, Ltd., Chicago

GE AUTOMATIC
PHONE QUIPMENT

under the control of a strip of push buttons mounted at three different subscribers' stations. With this arrangement either station can switch to either line to answer or make a call. Intercommunication is also possible by using a buzzer between stations. The same system can be equipped with a larger number of subscribers' stations.

There was also on exhibition the plug and jack arrangement, with which the desk stand cord is equipped with a plug that can be inserted in jacks mounted at different parts of a building so that the telephone can be used at various locations when needed. Only a few years back the No. 2 PBX was discontinued in most localities and the small features, such as the plug and jack arrangement, were frowned upon, as it was claimed by some that their extra maintenance cost offset any profit that might be derived from them. This may be true even today and perhaps the company could make more money by forcing something on the subscribers that they are not pleased with. But in view of the fact that the good will of the public is sometimes worth more than large dividends, it now seems that the attitude of most companies is to give the subscribers the type of equipment and service they most desire. This is perhaps the main reason that the "French type" phone was finally adopted in this country.

At the present time when outside plant is constructed it usually consists of underground cable and tree interference is seldom of consequence. In cases where cable or wire is placed in the air it may be necessary to trim trees to get proper clearance. If the owner is consulted before this work is started there is rarely any difficulty in getting permission to trim proper clearance. Instead of the old butchering tactics, trees are trimmed in a scientific manner, so that they are not injured in the slightest. It is getting quite common for telephone companies to call in a tree specialist in case of trimming valuable trees to prevent the risk of possible injury.

When placing underground conduits, especially inside the curb, there are some cases where owners are afraid trees will be damaged by ditching operations. If the property owners are consulted in such cases before the work is started locations can usually be arranged without the slightest injury to the trees or dissatisfaction to the owner. If poles are to be placed along a street and the property owners are consulted and the problems explained, they will usually consent to having the poles placed near the locations specified by the engineers. Approaching the property owners before the work is started gives them a feeling of confidence in the company and they know that the heartless corporation is not trying to take any advantage of them.

The best attitude for the company to take in all matters seems to be that, the subscriber is always right. This was proved to me a short time ago while visiting a commercial office when a lady entered with the full intent of cussing out the manager and settling her telephone bill. She was charged with a long distance call and six minutes' overtime. The manager very calm and patient got the original ticket, explained very carefully the stampings on the back and the timing arrangement which indicated nine minutes elapsed time. The lady was in a very ill-natured frame of mind and still refused to be convinced. The manager then asked her how long she thought she talked. She replied heatedly that she didn't think anything about it as she was certain that she didn't talk over two minutes. The manager still very calm replied, "Well, Mrs. Jones, we are very careful and try to avoid mistakes and our records all indicate that you held the line nine minutes. However, I know you are honest and I am perfectly willing to take your word for it as we might have slipped somewhere and made a mistake." The manager then proceeded to mark the call down to the rate for the minimum three minutes. The lady cooled down immediately and stated that while it didn't seem that she talked but a very short time, the company's records were so complete, she felt that she couldn't be sure and perhaps she did talk the full time of nine minutes. She then insisted on paying the full amount and left the office in a good humor. Had the manager let his temper get the better of him even for an instant, and argued with the subscriber over the call, it would not have mattered had he cancelled the charges in the end she would have left the office an enemy of the company. This incident convinced me that the honor system works as well and perhaps better in the telephone game than many others.

Another peculiar thing is, that in trying to please others, makes them try to please us, with the result that we both develop better dispositions, get more pleasures out of life and don't find our daily work such a care.

Telephone companies can grow large and powerful only as an instrument of service and their progress is limited only by that ability to render back in service to subscribers from which it has gained its power.

Northern White Cedar Association Annual Meeting January 22-23 at Minneapolis

Announcement has been made that the thirty-third annual meeting of the Northern White Cedar Association will be held at Minneapolis, Minn., January 22nd and 23rd, 1929. An interesting program is being arranged for this meeting.

Minnesota Telephone Convention Meets at St. Paul January 22-24

The annual convention of the Minnesota Telephone Association will be held at Hotel Lowry, St. Paul, Minn., January 22nd, 23rd and 24th, 1929. Copy of program has not been received but it is said that this is going to be one of the best in history.

Bell Telephone to Connect Lower and Upper Peninsulas

According to Manager Ripley of Holland, Mich., one of the most important and difficult telephone engineering feats of a decade in Michigan, the laying of another submarine telephone cable across the junction of Lake Michigan and Lake Huron, at the Straits of Mackinac, by engineers and plant crews of the Michigan Bell Telephone Company, is in progress. Nearly four miles of especially made, heavily armored cable, weighing 238 tons, or 476,000 pounds, will be spliced and dropped into place that day, connecting the two peninsulas of the state.

The project is one that involves unusual engineering and construction difficulties, because of the nature of the floor of the straits, the great depth of the water at various points and the possibility of severe storms interfering with the work. Construction crews already are on the job at St. Ignace, where the preliminary work is boing done preparatory to the laying of the cable.

The cable will cross the straits from points approximately two miles west of St. Ignace and Mackinaw City, and will be 19,400 feet in length. It will be laid from the northern shore, where it now is being loaded onto the cable boat. The cost of the job will approach $75,000.

Building Private Telephone Line

Nowata, Okla.—The Public Service Co. of Oklahoma has started work on a private telephone system which will connect all of its office and sub-stations in the northern part of the state with the general offices and the load dispatcher at Tulsa.

Millions of Everstick Anchors

EXPANDED

are in satisfactory service. Do you not think this convincing?

Order Eversticks through your jobber.

THE EVERSTICK ANCHOR CO.
Saint Louis, Missouri

Who's Who in the Telephone Business

FRED J. HEAVENS

An Appreciation by J. A. S.

Fred J. Heavens, of Elyria, Ohio, who demonstrated "Telering" at the last National telephone convention in Chicago, October 16-19, 1928, has many years to his credit in telephone operating, selling, etc. If he were not a married man I would hesitate to state just when he began. But his record is before me and I am going to divulge its contents, even though it jeopardizes his chances in the matrimonial sea in case of the demise of the good wife of this very active individual. We understand, however, that she never enjoyed better health than at this time.

Except for the present position of Fred with the Colson company, where he is in charge of a special department handling the sales of Telering and other electrical specialties, his Alpha and Omega has been at the same place—Kellogg's.

Beginning way back in 1899 Fred began his career with the Kellogg Switchboard & Supply company in the installation department. During 1900 he was made chief installer for the Federal Telephone company of Pittsburgh, Pa. The following year he was made manager of the McKeesport Exchange District, Federal Telephone company, Pittsburgh, Pa. Graduating from there we next find him as superintendent of the cable department of the Pittsburgh & Allegheny Telephone company of Pittsburgh. He was later made purchasing agent of the same company.

Fred J. Heavens.

From 1907 to 1914 we find him, first with the Pittsburgh & Allegheny Telephone company as improvement engineer; Continental Telephone & Telegraph company as appraisal engineer, and later telegraph engineer with the same organization; district manager of the Monongahela Division, Pittsburgh & Allegheny Telephone company.

During 1914 Fred was service engineer for the Western Pennsylvania Telephone Association. From latter part of 1914 until August, 1916, he was again connected with the Pittsburgh & Allegheny Telephone company as general commercial superintendent.

From that time until 1923 superintendent of plant of the Pittsburgh & Allegheny Telephone company. In April, 1923, he was made superintendent of plant, P. & A. Division, Bell Telephone company of Pennsylvania, and held that position until the following year.

In 1918 Fred served as president of the Western Pennsylvania Telephone Association.

And again in August, 1926, we find him back with his first love—the Kellogg Switchboard & Supply company as sales engineer for South America. This position he held until July, 1928, when he returned to Elyria, Ohio.

Had he received a medal for each job covered he would have looked like a Singalese soldier of the late war, who had swapped his experience in African golf for hero medals.

But what we want to say is, that his long experience in the different capacities which he has filled with credit to himself and the companies represented, qualifies him for the work he is now engaged in. He is now identified with the Colson company in putting very necessary equipment, Telering, on the market.

Mindful of the many pleasant contacts which it has made during the past year, and now concluded a most successful year, Telephone Engineer wishes its readers and advertisers best wishes for a prosperous 1929.

Comparison of Telephone Conditions in the United States and Europe

By WILLIAM H. O'BRIEN

Director of Telephone and Telegraph Utilities, Massachusetts Department of Public Utilities

One frequently reads and hears the statement that under government operation in European countries, telephone service is much cheaper than in the United States under private operation. As to actual dollars and cents, that is true in some countries, but as a practical matter that statement really means nothing, because, with the exception of Sweden, and perhaps Holland, there is nothing in the shape of telephone service in Europe that compares with that furnished by both the Bell System and the Independent companies of the United States. That doesn't mean they couldn't have just as good service over there, if they wanted it. The answer is, they have as good service as they think they need.

There is an old saying that "Trade follows the flag." In the case of telephone service here in America, the telephone has, as a rule, been a few steps ahead of business and social necessities all the time, and has easily become the most vital artery of our whole industrial structure and indispensable to the home and our social activities.

In other words, in this country "Business follows the telephone." Quite the contrary in Europe. Taking England for example—when the head of a business concern passes on and the business goes to the son, there is seldom any change in the character or volume of the particular business. It just goes along in the same old way so long as it produces a certain fixed amount, with no special effort to develop a progressive annual increase in volume and net results.

It is also interesting to note that even in the great city of London, most business establishments close entirely for the lunch hour. This is also true of many other places in Europe but particularly noticeable in London.

So with the telephone service over there, they have been content to develop that service as business and social activities demanded it, the reverse of conditions in the United States.

I confess that for many years I have believed that telephone service should be operated through a governmental department of communications to include the mail, telegraph and telephone. I wanted to confirm that opinion by personal observation and inquiry, as I have been unable to find anything in print on the subject, except what evidently was written with the idea that the whole telephone question was merely one of dollars and cents, with hardly any consideration for the real practical things, which, after all, are the biggest factors in the operation and development of telephone service. I have been forced to a somewhat different conclusion as the result of a fairly comprehensve observation of conditions in England, Sweden, Germany, Italy, France, Switzerland and Holland, during the past three years, and in that judgment I have not overlooked the many shortcomings of telephone service in the good old U. S. A.

In practically all European countries there is no unlimited telephone service. Under varying conditions and rates, in different countries, you are furnished a line with instrument for which a certain monthly charge is made without any allotment of calls. All service is paid for on a per-call basis.

In several countries, the rates are actually much higher than in the United States for a much inferior service. The Sweden service is much better than any of the other countries. They are very much up-to-date there, with rates comparable with those in the United States. The Sweden service in some respects is superior to that in this country. Their construction, equipment and maintenance is first-class.

Holland probably ranks second. As to the other countries, you "pay your money and take your choice."

With most of the European countries developing automatic telephone systems, the service should be of a higher grade and comparable with that in the United States, but that will depend almost entirely upon maintenance, which in the case of automatic must always be 100 per cent, otherwise the change from the manual to automatic service will be a case of "out of the frying pan into the fire."

With budgets subject to the political expediences and whims of the frequent changing governments, there will be lean years where service will deteriorate. This will be an added burden in later efforts to re-establish necessary business standards.

In the United States under private operation, those responsible for telephone service can never offer such an alibi as there have been but few cases where the public have quarreled about rates as against the necessity for the best possible service, even approving very generous dividends for those who furnish the capital necessary to keep pace with the constantly increasing demand for telephone service in rural communities as well as larger centers.

Under any other financial scheme it would have been impossible to extend telephone service to rural communities to anything like the extent it has been done in the United States, to say nothing of the extension of local exchange operating methods to long-distance points by which your call to a station hundreds of miles distant is completed under same conditions as a call for a station in the next street, without hanging up the receiver.

While I have prepared figures on rates and practices of European telephone systems, as compared with the United States, I have confined this comparison to a general statement without going into these figures, which, after all, are really not very helpful because of reasons stated above.

It is becoming evident all along the line in Europe that they are beginning to appreciate that telephone service is the biggest asset in the development of their commercial activities. This is particularly true of toll service, and such a story would not be complete without reference to the international phase of this whole matter.

It was not until the International Chamber of Commerce began its splendid work on European telephone-toll service that the representatives of the counties with membership in the International Chamber began to realize the tremendous importance of telephone-toll service in the commercial life of all countries.

In the consideration of this subject by the committee of the International Chamber of Commerce, every stress was laid

upon the importance of international telephone service as an efficient instrumentality for removing obstacles to international trade; thus stabilizing business through a more orderly and economic movement of goods; also that good telephone service tends to minimize the range of price fluctuations.

Just to show the practical results of the activities of the committee of the International Chamber, in two years, 1925 and 1926, the holding time on long-distance telephone calls between the principal cities of Europe was reduced as much as 50 and 75 per cent and practically all of the countries represented in the International Chamber agreed to do everything possible to guarantee a standard construction and maintenance on all long-distance lines. There was a general recognition of the fact that better telephone service meant more business.

To illustrate by one practical example: two years ago additional toll lines were added between Paris and Berlin and the toll business increased over 300 per cent in three months. This increase was almost entirely business service.

This great work of the International Chamber is carried on in a spirit of cooperation and helpfulness. It can be said without exaggeration that the International Chamber of Commerce is the greatest single influence in the world today for the development of a better and more permanent understanding between the peoples of the various nations which are members of the Chamber. That the development of trans-Atlantic telephone service, which was instituted a year or more ago, is helping very materially along the same lines is without question.

It must be understood, however, that the transatlantic service is not a secret service. As yet it can be picked up by any station attuned to a certain wave length. Experiments are now being made in the United States and England, which it is expected will correct this very definite handicap to the extension of this great service.

It is only when one has had the opportunity to observe the telephone situation in Europe, under conditions that I was privileged to enjoy during my three visits, one of which was as a delegate to the International Chamber of Commerce at Stockholm, that you realize what a tremendously vital asset telephone service has been in the United States, in the building of our great industrial structure, to say nothing of our social activities.

The Lincoln (Neb.) Telephone Company will spend $41,000 expanding the telephone service at Hastings. A twelve hundred pair underground cable is contemplated.

Meeting of Traffic Department, Illinois Telephone Convention

The traffic sessions of the progressive convention of the Illinois Telephone Association, which were held at the Abraham Lincoln Hotel in Springfield, Illinois, November 8th and 9th, were largely attended and were unanimously voted to be the best traffic sessions ever held at an Illinois convention.

The morning session was devoted to a "get acquainted" meeting, stunts and games helping to eliminate any feeling of strangeness on the part of those attending. The meeting was then adjourned to a general session of executives and traffic employees. This meeting was planned in accordance with the new desire for a closer relationship between the executive and the traffic departments, and both departments were enthusiastic over the results obtained.

The afternoon session was conducted along novel lines and was attended by some two hundred traffic employees. The plan used at the afternoon meeting has never before been used at a state meeting. There were six tables devoted to problems pertaining to toll operating, and five tables where problems of interest to the local operating people were discussed. Each of these tables was in charge of an acknowledged authority on the subject to be discussed at that particular table. Each table seated twelve operators and the instructor. These groups were rotated at twenty-minute intervals until each operator had attended one session at each table.

The telephone people attending this session were unanimous in their approval of this manner of conducting a traffic school, and it is probable that the next year's convention will be conducted altogether along this line.

The third and last session of the traffic people was devoted to a general resumé of the year's work. Several constructive and interesting papers were presented at this session. At this session also the delegates were privileged to hear a group of songs rendered by Miss Dais Tuscher, a soloist of exceptional charm and ability, and several piono selections by Miss Melba Freitag, a talented young musician who is also one of the telephone employees. One of Springfield's leading health authorities talked to the traffic people at this time on health problems peculiar to those in telephone work.

All in all, the telephone men and women attending this convention felt it to be the most worth-while and valuable meeting Illinois has yet held. The traffic sessions of the progressive convention were planned and conducted by Illinois' general traffic supervisor, Dorothy H. Van Ert.

Out of the Mail Bag

Del Rio & Western Telephone Company,
Del Rio, Texas, December 22, 1928.

Editor,
Chicago, Ill.

Dear Sir:

I have enjoyed very much and have profited a great deal by reading the articles by Mr. F. J. Dommerque and Mr. E. R. Collins. In fact, **Telephone Engineer is as complete and fine as can be for one interested in its field.**

I have never commented on any of the articles before, having just read and enjoyed them and profited thereby.

Wishing you a very merry Christmas and a prosperous New Year, I am

Yours very truly,
T. J. Paul, Wire Chief.

Brandon, Manitoba, Canada,
December 28, 1928.

The Telephone Engineer Pub. Co.,
Chicago, Ill.

Gentlemen:

Your kind wishes came too late to prevent me catching this darn flu. I thank you for the kind wishes, and the cheque. I believe I appreciated the letter the most, however.

I have been kept so busy in the evenings with this radio station that I was in fine shape to catch this national malady, and so Christmas day found me in bed, and all the rest of the family except my oldest daughter. I just got back to work today and I cannot see how I can get anything ready in time for the January issue. I am afraid I will have to pass it up for this month.

Yours very truly,
E. R. Collins.

Regina, Sask., Canada,
Dec. 26, 1928.

Telephone Engineer,
236 N. Clark St.,
Chicago, Ill.

Dear Sir:

I have just finished reading the series of articles on telephones repeaters by F. J. Dommerque and wish to express my appreciation of having been able to read them in your paper.

I would be pleased if Mr. Dommerque would give a series on the telephone carrier system as used on long distance lines giving schematic drawings of same.

Yours truly,
A. G. Grant,
Telephone Exchange.

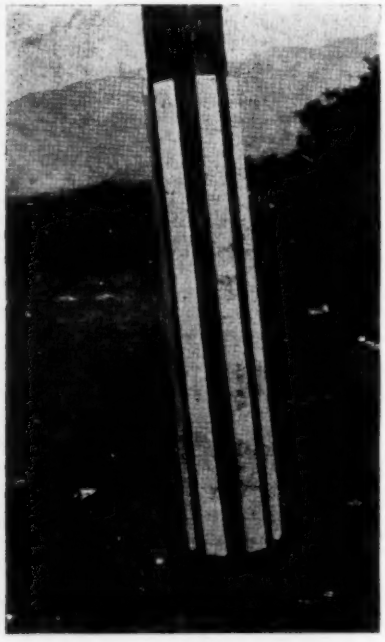
Place Cable to Improve Rural Lines at Aledo

Aledo, Ill.—Workmen for the Western Illinois Telephone company started recently to place more than four thousand three hundred feet of copper cable in the telephone system of the Aledo exchange.

LINE AND DESK

White Strips Make Pressure Creosoted Poles Conspicuous to Traffic

Painting poles white for about six feet above the ground line to make them conspicuous, particularly at night, has been practiced by pole-using utilities for some time in an effort to aid in the reduction of highway automobile accidents. This method has worked very successfully in the case of untreated poles, but with the increasing use of poles pressure treated their entire length with creosote it has become necessary to devise other methods to accomplish the desired results because of the impracticability of attempting to use white paint on these poles.



In the Lines of the Southern California Edison Company. Battens Painted White Are Nailed on Pressure Creosoted Douglas Fir Poles to Assist Visibility and Reduce Highway Accidents

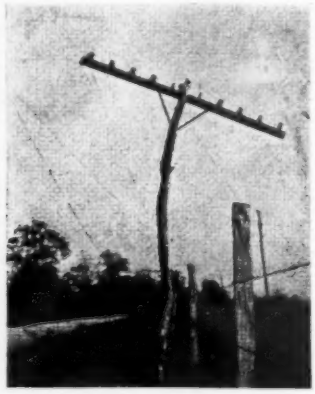
It has become quite common practice on railroad crossing gates, boulevard stop signs, etc., to use alternate black and white stripings to attract attention. This same "barber-pole" effect has been obtained by the Southern California Edison Company on black pressure creosoted poles by nailing white battens around them, as shown in the illustration. The pole illustrated is in a line of Douglas fir poles, 40 ft. in length, with an 8-in. top diameter, treated by an empty-cell process with 8 lbs. coal-tar creosote per cubic foot, located along Foothill boulevard, just east of Monrovia, California.

The battens are ¾ in. by 2½ in. by 5 ft., untreated, and painted white. They are nailed directly to the pole, and placed only around one-half the circumference of the pole, facing the direction of the traffic.

The visibility results obtained from the black and white stripes in this method of construction are claimed to be even more effective than in the case of untreated poles painted solid white. This method has been approved by the California State Highway Commission for poles located along state highways.—Wood Preserving News.

A PIONEER TELEPHONE POLE

This picture shows one of about the straightest Bois D'Arc poles that can be found on Toll Lead No. 7 between Idabel and Hugo. This lead was built about 1905 and the poles cost 50c each delivered. The picture shows one of the poles still standing as solid as it was twenty-three years ago. Approximately ninety per cent of the poles on this lead



are of this kind. All circuits were then No. 134 iron wire, which was replaced about 1926 with No. 104 copper wire. About ten per cent of the poles were replaced with creosoted poles.

The Bois D'Arc tree is a native of McCurtain County, Oklahoma, and that is where these poles came from. Some of these poles are so crooked that if you start to climb one you are liable to meet yourself coming down before you get to the top. And you ask if they are hard—say, Mister, if you ever start to climb one, be sure to have your hooks sharp and let your conscience be your guide.—W. H. Hatch, in Southwestern Telephone News.

A HOWLER STORY

Not so long ago in Washington a merchant had a telephone installed in the tiny office in the rear of his second-hand store on Seventh street.

All went well until one day, while he was in the front part of his store, the telephone in some manner was knocked off the desk (possibly by a passing employe) and naturally the receiver was dislodged from the hook. In a short time the subscriber had occasion to return to his office. But he got no farther than the door when he turned and ran excitedly out of his store and across the street to a public telephone in a drug store. Very soon he was talking to the trouble clerk.

"Send down quick your man. Mine telephone just hopped off the desk and lies on the floor crying like a baby!"

Nor would he touch the instrument until the troubleman arrived and placed it safely back on the desk with the receiver again on the hook.—The Transmitter.

A DIRECTORY ADVERTISING IDEA

It is surprising when we look at the number of Independent telephone companies that consider the issuing of a telephone directory merely a source of trouble, overlooking the fact that it can easily be made a source of added revenue.

Our company held that attitude for a short time and as a consequence allowed an outside concern to come in and reap the benefit giving in exchange the directory to the company free along with a few reams of stationery.

It is not our purpose to belittle the advertising companies engaged in that work, but more our purpose to show that a telephone directory is no trouble to sell, and that those participating do make a profit.

Local advertising in a telephone direc-

The Modern idea . . . Telephones here . . . there . . . everywhere

People throughout the country are gaining a new conception of telephone convenience in the home

* * *

PEOPLE everywhere are learning about this new conception of convenience in the home . . . telephones here, telephones there . . . located all through the house to save time and effort in placing and answering calls . . . telephone facilities *built in*, where possible, for permanence and better appearance.

Extension telephones add tremendously to the living comfort of every room. Small wonder people want them *throughout* their homes.

Many families regard two or more lines as an even greater convenience. One can be used for important incoming and outgoing calls when the other lines are in use, or, if desired, can be reserved for use by the servants.

The Bell System is carrying the story of complete telephone convenience to the public both nationally and locally. The advertising is designed to show how much genuine comfort and satisfaction can be had, at moderate cost, through adequate provision for residential telephone service. It should be of particular interest to telephone companies everywhere.

AMERICAN TELEPHONE & TELEGRAPH CO. AND ASSOCIATED COMPANIES — BELL SYSTEM

tory is better than any other type of local advertising, excepting, perhaps, the newspapers. However a newspaper is glanced at once, while the directory is referred to many times each day, and the space bought therein runs over a much longer period of time than in any other advertising medium we can think of.

It is admitted that a salesman must be sold on the product he is offering before he can put the sincerity behind his sales talk that is necessary to put over the sale. In that light it is well to remember that the directory is being referred to by some one constantly. The purpose of an advertisement is to place a product before the public and that is just exactly the result obtained from a space in the telephone directory.

This morning a switchboard salesman who has been in the Independent field gave us an idea that netted us $25 with five minutes effort on our part. That $25 is above all anticipated returns from the directory.

It is simply this. Each alphabetical classification, A, B, C, etc., is headed by the letters A, B, C, etc. We went to one of the local merchants and explained that with each of the 26 alphabetical listings we would run the head letter in big type and give him two lines in smaller type advertising the product he wished to push for sales. He thanked us for the opportunity. For example: Ask about skeesix radios, Palace Drug Store.

And so on down through the alphabet. It does not entail much more space in the book, does not mar the appearance and makes the name appear throughout the book in 26 different places in such a manner that people seeking numbers in the book cannot overlook that store and its merchandise.

Possibly you might not think $25 a sufficient charge for the spaces given to that concern, but directory space prices are determined by the number of directories to be placed in circulation and we considered the charge sufficient.

The thing to do is make a list of possible advertisers, meet them with confidence, knowing that you really have something worth while to offer them, and after making a sale secure copy for the space and the money for the ad if you wish.

Don't overlook a tag because it is a good seller being equally as good as the cover of the directory. We always explain that the tag will have a metal eye which makes it almost impossible to tear off the tag.—Contributed by Ernest Wommack.

A telephone in every stateroom has become standard equipment on most ocean liners.

Ramblings

By J. A. S.

The Bell Lumber Company of Minneapolis, Minn., writes us that it will be known as the Bell Lumber & Pole Company in future. This change is made, we understand, to more closely identify this firm with the pole manufacturing business. This is one of the oldest pole concerns in the country, and they have stood the test of time, and the three Bells who are actively identified with the organization ring just as true as did the old Liberty Bell in its prime. We are glad to list them as personal friends.

* * *

John W. Coffey is back home and feeling better than for some time, he says. "Jack" attended the National convention here in October, but since that time has been undergoing treatment at the Mayo sanitarium at Rochester, Minn. He's a good old scout and we are glad to know that he is again "sitting on top of the world."

* * *

J. G. Wray of Chicago, guiding spirit in the Standard Telephone Company, with headquarters in Chicago, spent a week visiting his properties in Texas and Oklahoma during December. He found conditions unusually good in the farming sections of those states, with reports that telephone service was in demand and increasing in a very satisfactory manner.

* * *

Chas. W. McKay, author of a series of articles in TELEPHONE ENGINEER entitled "Practical Suggestions for Plant Valuations," was a victim of flu during December. This was the reason for the non-appearance of his article in the December issue. He is now recovering and his regular article will be found in this number. His articles have enlisted commendation from many countries throughout the world. It is probable that he will cover another subject through these columns, beginning some time during the coming year.

* * *

January opens up a year of many state conventions, the first scheduled for South Dakota at Sioux Falls, January 15-17. The same month witnesses the Minnesota convention at St. Jaul, January 22-24. Indications point to a year of continued activity in the industry. The writer wants to attend them all; whether he will be able to do so or not he cannot say. It's a genuine pleasure to meet old friends at these conventions, but the early meetings in the far north will tax our southern will-power to the limit.

That pesky old disease called "flu" is responsible for much suffering and disorganization of programs from all over the country. Ed. Stewart of Stewart Bros. of Ottawa, Ill., is one of the victims; E. R. Collins, special writer for TELEPHONE ENGINEER, is another; Roy and Ray Smith of Fort Worth, sons of the writer, add to the total.

* * *

Wilbur L. Lefean, president of the Naugle Pole & Tie Company, of Chicago, was called to York, Pennsylvania, December 17th by the death of his father, Albert Henry Lefean. Interment took place at York December 19th. Affection of the heart was the cause of death, we understand. Mr. Wilbur Lefean has many friends among the telephone fraternity as well as other lines of public utilities, who deeply sympathize with him in the death of his father.

* * *

F. M. Hoag, vice-president of the Southwestern Bell Telephone Company, with offices in St. Louis, motored through to Texas during December, making many stops on his way visiting properties under his control. He found conditions better than fair on his southwestern trip and considerably warmer than even his St. Louis home.

* * *

J. C. Carpenter, manager of the Vienna branch of the Illinois Commercial Telephone Company, died at his home at that place December 4th and was buried at Marion, Illinois. He formerly resided at Energy, Ill., where he had many friends. He had been engaged in the telephone business for many years. Mr. Carpenter leaves the wife and two children.

* * *

Sure there is a Santa Claus. He left several new advertising contracts in TELEPHONE ENGINEER's sock Christmas. He seems to be getting more generous, too, as time goes on. We *believe* in a hereinafter, heretofore and here, but we *know* there is a Santa.

* * *

A persistent demand for back copies of TELEPHONE ENGINEER has caused us to be too generous for our own good, and we find ourselves sorely in need of several copies of March and June issues of 1928, and October, 1927. For your trouble we will issue you a credit of six months for each copy of these numbers sent us, and we'll thank you besides.

* * *

Benjamin Woodbury, special sales representative, and E. R. Stonacker, traffic engineer for the Stromberg-Carlson Company, have just returned from an extended trip through the Eastern and Central states, where they called upon the general telephone and radio trade.

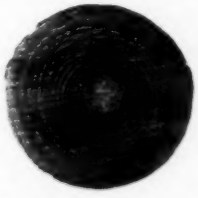
One tiny vulnerable spot — Death found it!

THETIS, goddess mother of mortal Achilles, Hellenic hero of Trojan war, plunged him into the River Styx to make his body invulnerable. But she held him by one heel, which the waters did not cover with their protective charm. Before the bloody walls of beseiged Troy, Achilles wrought havoc and destruction among the Trojans, himself escaping wounds, defying harm. And then, as he stood in the temple of Apollo, negotiating with Priam for the hand of his daughter, Polyxena, the poisoned arrow of treacherous Achilles found his vulnerable heel, dealing death. The magic of the Styx was good protection as far as it went. But its application had lacked thoroughness.

It is fact, not legend, that destructive termites (white ants), woodpeckers, decay-producing fungi or marine borers are swift to find the vulnerable spots in partially, improperly or under-treated transmission poles, cross ties, bridge timbers or piling. Spotty or uneven penetration of the preservative does not afford complete protection. And treated wood is no safer than its least protected spot.

Thoroughness distinctively characterizes Prettyman timber preservation. The most complete and modern pressure treating plant in the industry, coupled with finished engineering skill and care, assure deep and uniform penetration full length to the heartwood with creosote oil conforming to standard A. R. E. A. specifications. It completely encases the heartwood in highly toxic sheathing, thick as the sapwood itself. It leaves no vulnerable spots. Yet, Prettyman Preserved Forest Products cost no more. Write for prices.

No vulnerable spots here!



PRETTYMAN PRESERVED FOREST PRODUCTS P29

Note thorough penetration of creosote oil.

J. F. Prettyman & Sons
Wood Preserving Plant
Charleston, S. C.

These two men report business conditions through the sections they traveled as extremely good, and that orders and prospects obtained indicate very optimistic business conditions for 1929.

* * *

Downtown Chicago pay-station telephone service has been very much upset the past two weeks because the Illinois Bell Telephone company presented a new contract to hotels, drug stores, cigar stores, and others who have pay-station connections. The old contract, which expired December 31st, was a sliding scale, ranging from 20 to 50 per cent of the gross income. Under the new contract, which many are resisting, a flat rate of 22½ per cent is offered. Considerable confusion has resulted and many jelly beans have failed to meet their shebas on account of inability to get 'phone service. And the offices in the loop have been besieged with "friends" who wished to use their 'phones.

* * *

The "ill wind" came with a rush January 1st to many states of the North. Snow and winds did much damage to telephone properties in several states. But it was pretty while it lasted, and the writer spent much time driving in his first winter experience of Illinois and Wisconsin snowstorms.

* * *

The American Telephone & Telegraph company has announced a slight reduction in long distance telephone service where the distance is more than 130 miles. The reduction is for daylight service and becomes effective February 1st. A saving of from 5 cents to 25 cents on each call is promised. The public will doubtless appreciate this reduction, but we cannot but wonder how much more the connecting companies would have appreciated the increase, and if this would not have been a better way to insure better service to the public.

* * *

The Orange County Telephone company of Middletown, N. Y., sends us clipping from its home town showing attendance record of a few of their operators. These operators show enviable records and we regret we cannot publish them, as we believe they are far above the average. Forty-seven operators are now in the employ of this company. We've stuck a pin in our map for Middletown and the next time we pass through New York we are going to pay a visit to this very efficient exchange.

New Telephone Circuits

The Illinois Northern Telephone Co. has completed the installing of three new telephone circuits between Macomb, Blandinsville and LaHarpe.

$5,000,000 Cut in United States Phone Rates February 1

New York.—Substantial reductions in long distance telephone rates to all parts of the United States will be made February 1 by the American Telephone and Telegraph Company, according to an announcement made by Walter S. Gifford, president of the company.

The saving to the telephone using public will be more than $5,000,000 a year, the company estimates. The announcement of the forthcoming reduction, timed for the last day of the past year, is in effect a New Year's gift to the people by the company.

Follows Old Policy

The American Telephone and Telegraph Company has had the present move under consideration for some time, but formal announcement was delayed until all details had been settled. The reduction in long distance rates is the third that American Telephone and Telegraph and associated companies have made in two years and four monthhs, and is in line with the company's settled and well known policy of providing the best possible service at the least cost consistent with financial safety. Growth of long distance telephone service and the freer use of these facilities by the public alone are responsible for this latest cut in rates.

Earnings more than sufficient to provide the best service will, under our policy, either be spent for the enlargement and improvement of the service furnished or the rates charged for the service must be reduced," Mr. Gifford said in announcing the company's policy some time ago.

Service Is Improved

"Both things have happened, the rates have been reduced and the service improved. During 1928 there was a continuous improvement in the speed with which toll and long distance calls have been handled. The fact that more than 90 per cent of these calls are now handled while the subscriber remains at the telephone has been one of the influences that has brought about the steadily increasing use of long distance facilities that marked the year.

"Another improvement is the extension of the country's network of intercity telephone cable, which is practically storm-proof and provides dependable long distance service between centers of population. The construction of 1,500 miles of such cable during 1928 is a record for any single year."

Rates of Reduction

The new schedule of rates that goes into effect February 1 cuts from five cents to twenty-five cents on charges from station to station calls between points from 150 to approximately 1,000 miles apart. Middle distance rates will enjoy reductions as high as 13 per cent. An equivalent rate reduction will be made for person-to-person service. Evening and night rates will remain at their present level. For a call from New York to Chicago the basic station-to-station day rate is reduced from $3.25 to $3.00.

A New York to Palm Beach call or one between Denver and San Francisco will cost $3.75 instead of $4. Separate rates for appointment and messenger service under the new schedule are eliminated, these services being offered after February 1 at regular person-to-person rates.

Empire Companies to Extend Phone System

Bartlesville, Okla.—Announcement is made by officials of the Empire Companies of plans to extend the present private telephone system, comprising about 3,000 miles of line in Kansas, Oklahoma and Texas, by constructing a line to Glavin station on the outskirts of Kansas City, Mo.

The present telephone lines terminate at Grabham compressor station, near Independence, Kan., and the extension will provide a metallic circuit furnishing both telephone and telegraph service to the Petrolia compressor, near Chanute, Kan., to the Ottawa cross-over station, near Ottawa, Kan., and into the Glavin station.

It is expected that the line will be completed within 60 days after the work is commenced on Dec. 1. This construction project is the largest single project undertaken by the Empire companies since the completion late in 1927 of a 300-mile telephone line from Ponca City, Okla., to Pampa, Texas, which extended service from the famous Burk Burnett ranch, center of the Empire's gas reserves in the Texas Panhandle.

Work Resumed on Tiffin Telephone Building

Tiffin, O.—Delay in building of the Tiffin Consolidated Telephone Co.'s new exchange here ended when a shipment of terra cotta arrived.

Work had been suspended for more than a month because of delay in shipment of material. An extra crew of men were put to work although W. D. Crawford, telephone manager, said completion of the building would not be possible before June.

EXTRA LIFE!

...makes these Ray-O-Vacs better for telephone service

NOT only longer life—but extra, *peppier* life in these Ray-O-Vac Telephone Batteries! More snap and power — assuring a more lasting and improved quality of sound transmission, economy in service, and better satisfied customers!

Exhaustive scientific tests have proved that Ray-O-Vacs have greater recuperative powers than ordinary batteries and maintain a higher voltage level throughout their useful lives.

Get this *extra* life. Cut your replacement costs. Improve your telephone service! These advantages are yours for the asking. Just specify Ray-O-Vacs when you buy batteries.

FRENCH BATTERY COMPANY

Factory: Madison, Wisconsin
Sales Office: 30 N. Michigan Ave., Chicago, Ill.

Branches: New York, Chicago, Minneapolis, Kansas City, Atlanta, Los Angeles

RAY-O-VAC

Also Makers of Ray-O-Vac Radio Batteries, Ray-O-Vac Ignition Cells, Ray-O-Vac Flashlights and Flashlight Batteries

"TU" Becomes "Decibel"

By R. V. L. HARTLEY

Transmission Research Director, Bell Telephone Laboratories

Some years ago the mile of standard cable was displaced as the unit of transmission in the Bell System by a younger brother. This newcomer in the family of transmission units, being without a given name, adopted that of the family and became known as the "transmission unit" or "TU." It has now been given the more distinctive title of "decibel," commonly abbreviated "db." The prefix "deci" indicates one-tenth, while "bel" is derived from the name of Alexander Graham Bell.

The members of the transmission unit family resemble each other in that they all measure the logarithm of the ratio of two powers, currents or other quantities which express the magnitudes of the waves being compared. This is a desirable property from two standpoints. First, it insures that two sounds of the same general nature and quality which differ by a given number of transmission units have the same difference in loudness regardless of their absolute loudness. The difference in loudness of two sounds may be measured by the number of intermediate steps that can be distinguished in passing from one loudness to the other. Within the limits of accuracy of Weber's law, in order to produce a recognizable increase in loudness, the intensity must be multiplied by a factor which is independent of the actual intensity. Hence the number of recognizable steps is equal to the number of times which the smaller intensity must be multiplied by this factor to give the larger. This is the exponent to which the factor must be raised to equal the ratio of the two intensities, and by definition is the logarithm of the ratio of the intensities to a base equal to the minimum recognizable intensity ratio. It follows, therefore, that the logarithm of the intensity ratio to any base will always be proportional to the difference in loudness and so a logarithmic unit becomes a suitable measure by which to express the effect of a transmission system on the loudness of the received sound.

In the second place, the use of a logarithmic unit facilitates the deduction of the overall transmission properties of a system from those of its parts. Suppose, for example, that some telephone system is being compared with a reference system. We may picture the test system as being derived from the reference system by successively replacing each part. Each change causes the received power to change in a particular ratio. By multiplying together all these ratios we get the ratio in which the power is changed in going from the reference to the test system. If, however, we measure the effect of each replacement by the logarithm of the corresponding ratio, we have only to add the effects of the individual steps to get the overall effect.

The International Advisory Committee unanimously recommends the following definitions:

The unit of transmission expresses the ratios of apparent or real power, of potentials or of currents in transmission systems. In practice, the number of units of transmission in a given case is expressed in terms of a logarithm.

If it is a case of two powers P_1 and P_2, the number of units is:

In the naperian system, $\frac{1}{2} \log_e |P_1/P_2|$;

In the decimal system, $\log_{10} |P_1/P_2|$.

If it is a case of two voltages V_1 and V_2 or of two currents J_1 and J_2, the number of units is,

In the naperian system, $\log_e |V_1/V_2|$ or $\log_e |J_1/J_2|$;

In the decimal system, $2 \log_{10} |V_1/V_2|$ or $2 \log_{10} |J_1/J_2|$.

The naperian unit is called "neper." The decimal unit is called "bel." A decimal sub-multiple of these units may be used, as "decineper" and "decibel."

The members of the family, while alike in being logarithmic, differ in the base to which the logarithm is taken. However we may go from one base to another by introducing the proper multiplying factor. Hence the difference between the various units is effectively one of size only. Among the units in use when the TU was chosen, the 800 cycle mile of standard cable is of such size that the number of miles is given by $10.56 \log_{10} P_1/P_2$, where P_1 and P_2 are the two powers involved. For the so-called β1 unit then in use in parts of Europe the number is $\frac{1}{2} \log_e P_1/P_2$, or what is equivalent, $\log_e J_1/J_2$, where J_1 and J_2 are the currents involved. (When currents are used it is assumed that they flow in equal impedances.) If we transform the β1 unit to common logarithms the number is given by $1.151 \log_{10} P_1/P_2$. In order that the TU might be roughly equal to the "mile of standard cable," the size selected for the TU was so chosen that the number of TU is $10 \log_{10} P_1/P_2$.

In view of the desirability of the universal use of one unit for telephone transmission work, the Bell System took up this matter with various foreign telephone administrations and suggested that they consider the TU for this purpose. This led to considerable discussion as to the relative merits of a transmission unit based on common logarithms such as the TU, and one based on natural logarithms such as the β1 unit. Action was finally taken in the form of a recommendation by the International Advisory Committee on Long Distance Telephony of Europe to the effect that the use of both units be recognized as standard in Europe.

It was also recommended that distinguishing names be assigned to the two transmission units. For the β1 unit, which is so defined that the number of units is given directly by the natural logarithm of a *current* ratio, the term "neper" was chosen in honor of John Neper,* who first conceived the idea of logarithms. In the case of the TU, however, the common logarithm of a *power* ratio is multiplied by ten to get the number of units. This suggests that the TU is in the nature of a derived unit and that the primary unit should bear the same relation to the common logarithm that the neper does to the natural logarithm. The name "bel" was accordingly assigned to this primary unit. Since the number of TU corresponding to a given ratio is ten times the number of bels, the TU itself is equal to one-tenth of a bel, and so it became the "decibel."

In view of this recommendation, the Bell System has decided to use the term "decibel" as a name for the transmission unit. The transition from the old to the new will naturally be a gradual one. There will be no occasion to make changes in existing apparatus or written material, but rather the db will replace the TU in new work.

*While this spelling may appear unfamiliar, the form "Napier" is comparatively modern. The name appears to have been going through a transition during the mathematician's lifetime and while his signatures show a variety of spellings, he generally used the oldest form "Neper."

Telephone Company Making New Improvements

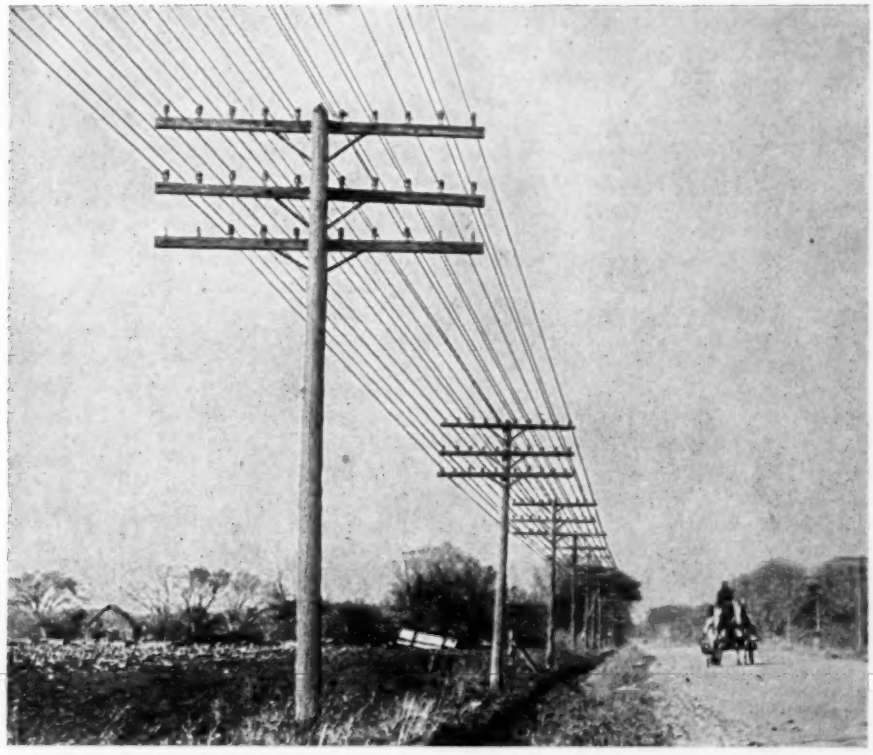
The Tri-State Telephone Company, with headquarters at St. Paul, has a crew of men at work in Faribault preparing to put in additional underground cables. Charles Quinn, general construction foreman, is in charge of the work.

The cables, which when completed will supplant the telephone pole and overhead wire system now in effect on some streets of Faribault, will be laid in three different sections.

Time-Tested – Why Experiment?

Northern White Cedar always has been, and still is

The Ideal Telephone Pole



Northern White Cedar Poles in toll circuit lines of Home Telephone Co., Joplin, Mo., set in 1905

USED by our forefathers as the best available, nothing has yet been discovered that is better or even equal to Northern White Cedar in *all* essential features.

Light weight—easy to handle,

Strong—large diameter where strain is greatest,

Large butts—solid anchorage,

Long-lived—wonderful records of years in service.

You can cut gains and put on new cross arms at any time without exposing pole to decay.

Northern White Cedar Association

Minneapolis - Minnesota

Northern White Cedar Poles

New York Telephone Company Has Largest Program in History

The largest plant construction program in the history of the New York Telephone Company, calling for the expenditures of more than $90,000,000 in 1929, is indicated in the provisional estimates for the year, according to an announcement made today by J. S. McCulloh, president. This compares with nearly $71,000,000 expended in 1928. About two-thirds of the total is to be spent in New York City, where 7,760,000 of New York State's 11,600,000 daily telephone calls originate.

"These expenditures," Mr. McCulloh states, "are planned to provide adequately in advance for the continued growth in the already enormous telephone requirements of the public in the State of New York and that part of Connecticut served by this company. The estimates cover the necessary gross outlays in 1929 for land, buildings, switchboards, cable, and the various other eequipment which make up the telephone plant.

"As in the case of the Federal government, whose practice of budgeting its prospective expenditures is now well known, the telephone company for a number of years has prepared provisional estimates of construction needs both for one year and for five years, basing these on careful forecasts throughout its territory.

"The construction program must reflect not only current and prospective growth in telephone needs but the continuous progress that is being made in telephone science and engineering, and is therefore planned with full regard to utilizing such new or improved devices and methods as will contribute to the efficiency of telephone operation and transmission."

In the program both for 1929 and for the five-year period now beginning, conspicuous place is given to the replacement and improvement of central office equipment, the erection or enlargement of buildings to house this part of the general plant, and additions and improvements to toll facilities. The estimated expenditures for land, buildings and central office equipment alone is $38,000,000 in 1929 and nearly $190,000,000 in five years.

For these purposes more than $26,000,000 in 1929 and $140,000,000 in five years will be applied in New York City, where the plans include the further replacement of manual switchboards by dial equipment. By the close of 1933, the end of the five-year period, it is expected that this conversion will be practically complete in Manhattan, and two-thirds of the telephones in Brooklyn, more than one-third of those in the Bronx, and more than two-thirds of all telephones in the city as a whole, will then be served from dial central offices. At present, 27 per cent of the city's telephones are thus served.

Approximately $7,000,000 for 1929 and $26,000,000 for five years are the estimated requirements for land, buildings and central office equipment in the upstate area, comprising all of New York State north of Westchester and Rockland counties. Besides providing for growth, this money will be spent to effect the complete cut-over to dial system equipment in Albany, Schenectady, and Syracuse. It is planned that the manual equipment in Buffalo will be completely replaced by the dial system by the middle of 1934. Replacements of the present manually operated system with the dial system operation have been planned for Troy, North Troy, Waterford, Cohoes, Watervleit, Binghamton, Johnson City, South Syracuse and Solvey.

An extensive toll line construction program, including several joint projects with the American Telephone and Telegraph Company, involves expenditures by the New York Telephone Company of $7,500,000 in 1929 and $30,000,000 in the five-year period. By the end of 1933 more than 95 per cent of all the company's telephones, as compared with 90 per cent at present, will be connected with the toll cable system, which, with storm-proof cable and other improvements, is designed to provide increased dependability and speed in toll and long distance service.

The major toll cable projects include the construction of an underground conduit route 190 miles long from New York City to Albany and Schenectady, this to be completed as far as Catskill in 1929. Another underground conduit route is projected between New York City and Stamford, Conn., enlarging the service facilities with New England points. The Albany to Saratoga Springs section of a cable route to Montreal is scheduled for completion this year, as is also the Schenectady to Syracuse portion of a through route to Buffalo and west. Other cable routes to be completed in the five-year period will extend from New York to Syracuse by way of Binghamton, and also through the latter city to Buffalo by way of Elmira. Improved toll facilities will be provided to Catskill Mountain points.

Other projects affecting main toll routes will expend the service facilities to the metropolitan suburban areas, and to New Jersey and long distance points westward. To upstate and to New Jersey there are at present 27 toll cables crossing the Hudson River from Manhattan. Five will be added in 1929 and 14 during the succeeding four years.

During the five-year period, 11 repeater stations, which house the amplifying equipment for toll and long distance service, will be added to the 13 already on the main cable routes, thus assuring a high standard of voice transmission over the expanded facilities.

Bell Cable Network Will Cost Millions

Oklahoma City.—Construction of a $45,000,000 long distance cable network to connect the principal cities of Missouri, Kansas, Oklahoma, Arkansas and Texas has been begun by the Southwestern Bell Telephone Company. About 2,500 miles of cable, much of it underground, will be installed within five years. The overhead pole lines now composing the inter-city communication system will be rearranged to handle service over shorter distances. The first 100-mile section of the cable, from Oklahoma City to Holdenville, is already under construction. "This cable system is the realization of a dream of many years," said R. J. Benzel, general manager of the Southwestern Bell Telephone Company in Oklahoma. "The loading of pole lines with increasing numbers of what we call 'open-wire' telephone circuits to meet the rapidly growing telephone requirements of the southwest has made the effect of sleet, windstorm and flood a matter of great concern." Adoption of this program means large advance construction expenditures and much of the money cannot yield a return for several years, according to Mr. Benzel. The advanced program, however, has been adopted in order to keep pace with the rapid development of the southwest, Mr. Benzel said. About 400 miles of the new cable system will be built during 1929 and the rest as rapidly as possible.

Picture of Voice Phoned Across United States

New York.—Photographed sound was transmitted by telephoto process for the first time Dec. 11, when officials of the American Telephone & Telegraph Company received actual pictures of an actor's voice in seven minutes from Los Angeles in New York City.

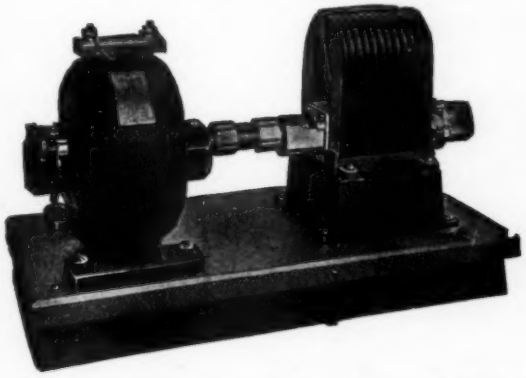
Three words, "Is that so?" were spoken in Los Angeles by William Haines, photographed on a sound strip (or movietone light record) and the latter divided into pieces about the size of ordinary photographs.

Enough telephone wire to girdle the earth ten times has been added to the Bell telephone plant in the Provinces of Ontario and Quebec in Canada during 1928.

HOLTZER-CABOT

Magneto - Ringing - Motor - Generators

SERVICE ASSURED



It is no longer necessary to undergo periodic and unreliable ringing service.

Holtzer-Cabot Magneto Ringing Motor Generators installed will mean satisfactory uninterrupted service at low cost.

Can be operated from light socket. Eliminates troublesome battery equipment.

Requires no attention other than occasional lubrication. These sets are convenient and positively dependable in operation. Can be supplied for any voltage or special current.

We will gladly furnish you with complete data at your request.

HOLTZER-CABOT ELECTRIC CO.

125 Amory Street, Boston, Mass.

6161 So. State Street, Chicago, Ill.

Guaranteed All Weather Furnaces!

No. 79 Quart, No. 80 Pint. Gasoline-Kerosene. Covered by Patents.

The recognized reliability of these torches and furnaces has won them wide popularity among telephone service men. However adverse the weather conditions are under which these men must work, they can always depend on the "Always Reliable" brand torches and furnaces. The differences, too, in Bernz construction make work easier, faster and more economical.

Order now through your distributor and ask for our catalog giving full information.

"Always Reliable" Since 1878

OTTO BERNZ CO., *Inc.*

NEWARK, N. J.

An iron that is *instantly hot*

TO electrical contractors, linemen, etc., the Prest-O-Lite 5-in-1 Outfit offers a convenient, portable, easily handled soldering iron instantly hot for any soldering job, and by a simple adjustment a hot concentrated flame for general brazing and heating work.

This Outfit is always ready—you simply turn on the gas, light the torch, and the job is under way.

The 5-in-1 Outfit is furnished with an assortment of four interchangeable torch heads in addition to a detachable soldering copper, which enables you to apply the exact amount of heat and the proper flame for every purpose.

THE PREST-O-LITE COMPANY, Inc.

Unit of Union Carbide and Carbon Corporation

UCC

NEW YORK Carbide and Carbon Bldg. SAN FRANCISCO Adam Grant Bldg.

CHICAGO Peoples Gas Bldg.

Any one of 15,000 Prest-O-Lite Exchange Stations can supply you quickly with a full tank of Prest-O-Lite Gas.

Prest-O-Lite GAS

The Telephone an Important Factor in Any Community

The *Republican Journal* of Caldwell, Ohio, November 28, 1928, printed the following account of an address delivered by C. L. Jones of Athens, Ohio, before the Kiwanis Club of that city:

How little is the appreciation extended to the telephone—how few the thoughts of just what it all means to any given community. And at the same time how easy it is to find fault. The obstacles that arise in the telephone service are many. The elements are to deal with, the ravages of time wrought many difficulties. And with it all the telephone goes merrily on and every home and every business is in direct and immediate communication with the rest of the world.

It is mighty pleasing to have an expert, a man who is far up in the telephone world, one that has worked wonders in the solution of the telephone business come to town and after giving the local exchange the once over, say nice things about us and point the way to betterment of the plant that will bring about better service. This after complimenting the local company and its officials, managers and workmen.

This came about Tuesday when Dr. C. L. Jones, of Athens, of the Home Telephone Co. of that city city came to town. This just on a friendly visit and while here he looked about him, naturally his vision took in the telephone situation.

He was invited to attend the Kiwanis Club meeting Tuesday evening and was called to the floor and thus he spoke:

"Mr. President and gentlemen of the club:

"You will soon agree that my coming here was not on account of my speaking ability, but more the result of my having served our local community with a satisfactory brand of telephone service for a period of some 30 years past. I will endeavor to bring you evidences of how satisfactorily you can be cared for by a local telephone company like you have here where there is sufficient local influence to insure the situation what they need in the way of service. Some foreign corporation might not be so earnest in their endeavor to please you.

The success of the local enterprise will depend on the support you accord it in the payment of fair rates as a starved enterprise will not help your town. I have heard it said many times that a town can readily be rated by the conditions of the utilities operating therein.

In Athens we have 168 stockholders all of whom we count as real, honest to goodness boosters. If any service problem would come up affecting our welfare you can readily imagine where we would go for support and sympathy.

Two years ago in contemplation of a very extensive program of improvement we applied for an increase of 33 per cent on all of our rates and was one of two telephone companies in Ohio that were granted the rates they asked for without a protest being filed with the commission at Columbus.

You can't get blood out of a turnip nor can you get the kind of telephone service you need unless your local company is supported with your commendation and adequate finances.

In club and lodge activities it has been said that you get out just what you put in them. The same can be said of telephone and other utility service. You can have them as good or as bad as your support justifies.

Your little city should be proud of having produced such a man as my good friend V. Pres. C. P. Cooper of the A. T. & T. Co. I have visited him at his office at 195 Broadway and am sure that he has a special interest in Caldwell as well as the entire state of Ohio where for some years he was President of the Ohio Bell Telephone Co. Such affiliations should always insure Caldwell the best there is in telephone service as a necessary support for any reasonably good local company situation.

You have the good fortune to be located on one of only about three main north and south toll leads that cross the state of Ohio. How much better off you are in this way than our city of Athens where we are located at the tip of a line extending 75 miles S. E. from Columbus. The importance of this advantage to you cannot be over estimated.

I have not come here to find fault in any way with your local situation in a telephone way, nor have I come to bore you with any story of our local success at Athens. If I can be of any assistance in working out any of your problems in service or financing I will be very glad to and will appreciate it when through if I can answer my inquiries relative to the advantages of a locally operated system over that of those operated by a foreign corporation.

Besides giving Athens an automatic service as good as any city in the U. S. the Home Co. has done more to improve the civic beauty of our little city, than the light, water, or gas companies. Part of our success lies in the fact that we have tried to have our enterprise with directors, etc., as local in character as possible. Employes are all local people and all expenditures for supplies as near as possible are made with local merchants. You may be interested in the picture of our new building. I am handing around. But more interesting is the marvelous little dial which with its accuracy of operation, replaces the "hello girl."

Unlike many exchanges I know of you have an extensive rural development due to the very low price charged for service. With this low revenue situation is bound to follow a service of restricted efficiency. The best or even good service costs real money, and as in many other things you get in efficiency in telephone service just about in proportion to the amount of financial support or rental you pay for it.

In merchandising transactions many people buy the best, but when it comes to telephone service anything seems good enough. In the rural section the lines hang out in the weather for from 5 to 10 years without a cent of repair. Money is spent to maintain farm machinery and other equipment but any spent to repair the old rusty fence wire telephone line is considered almost thrown away.

A fire or a case of typhoid fever in the home should make dependable telephone service pay for itself for years to come yet how disgusting is a service of an undependable character especially should you wish to reach your physician at 2 a. m.

You hear much talk about this company and that company selling out to some bunch of brokers who have little or no regard for the service needs of the community. The facts are that a majority of those selling are ones where there has been some failure at some angle of the situation such as an inability to secure adequate rates or some dissension among the directors or stockholders. Very few successful companies have considered such a procedure.

Quite a misunderstanding exists relative to the disposition of the Commission in many matters. They are not any arbitrary body that many suppose. One of their important functions being that of seeing that a company renders uniform and impartial treatment to all for similar rates. When it would be supposed that a company could employ a number of different methods and rates in serving its patrons it must be remembered as stated above that such is not in accord with their idea of a real public service. How appropriate it would be to apply to the service situation the old phrase of the people by the people and for the people. I have stated on many occasions as to the value of the 'Customer Owned Utility Service.' It may be of interest to you to note how much importance the Bell Co. attaches to the 'customer owned' feature of its financial program. With nearly half a million stockholders, thus the world's largest corporation is the one you are depending

Get EVER-PROTECT aid in your construction.

EVER-PROTECT has proved practical and profitable in making many hundreds of cable installations underground without a conduit. It protects cable against storm damage, corrosion, chemical action, electrolysis and abrasion.

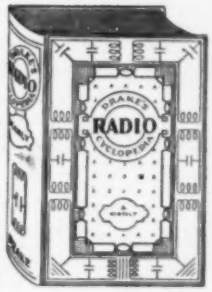
In liquid form EVER-PROTECT is great for overhead work, protecting your cable and messengers against chemical action and other destructive influences.

Ask your nearest jobber for complete details.

EVER-PROTECT CABLE COMPOUND

TRADE MARK REG U S PAT OFF

National Cable Compound Co.
Incorporated
MITCHELL - - IND.



DRAKE'S RADIO CYCLOPEDIA
By HAROLD P. MANLY

A Complete and Non-technical Reference Work, covering nearly 1700 subjects arranged alphabetically, including instructions for building, operating and testing receivers, power units and radiophone equipment. Arranged for use by set builders and designers, service and repair men, dealers and salesmen, experimenters and students, set owners and operators. 871 Pages. Size 6x9". 985 Illustrations. Circuit Diagrams, Constructional Layouts and Graphic Curves. All made especially for this book. Bound in Art Buckram. Stamped in Two Colors. Price $6.00

Send Order Direct to

TELEPHONE ENGINEER
192 N. Clark St., Chicago, Ill.

Exide
BATTERIES

With an Exide battery on the job, a long life of dependable, trouble-free service is assured. That is why Exides are so generally used by the telephone systems throughout the country.

THE ELECTRIC STORAGE BATTERY CO.
PHILADELPHIA
Exide Batteries of Canada Ltd., Toronto

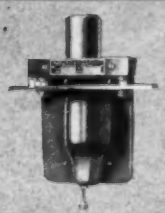
STANDARD
Paper Insulated Telephone Cables
STANDARD

are so protected mechanically and electrically as to insure the highest quality of service with a minimum expense for upkeep. For further information write our nearest office.

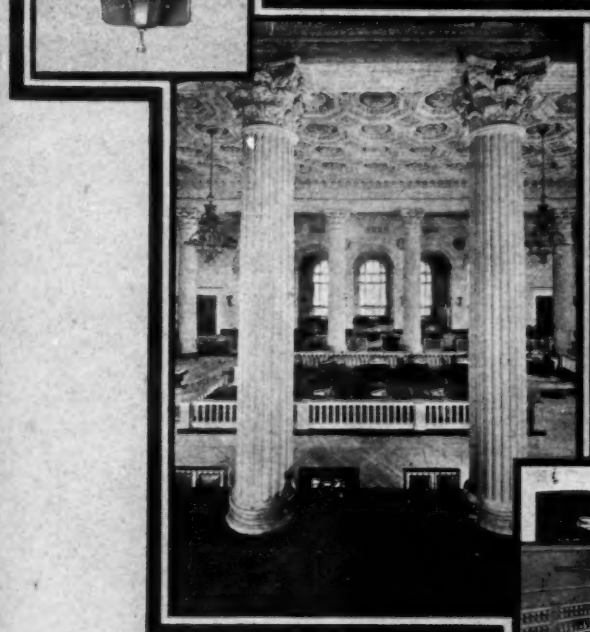
Standard Underground Cable Co.
Division of General Cable Corp.

Boston	Washington	Chicago
New York	Detroit	Philadelphia
Pittsburgh	St. Louis	San Francisco
Atlanta	Kansas City	Seattle
Birmingham	Charlotte	Los Angeles

For Canada: Standard Underground Cable Co. Of Canada, Limited, Hamilton, Ont.



SIGNAL ENGINEERING STANDARD



S. W. Straus & Co., noted for efficiency and progressiveness, uses *Signal Engineering* Standard Call System in its beautiful Chicago offices.

CALL SYSTEM

ASSURES PROMPT
COMPLETION OF CALLS

Broadcasts code calls with soft mellow tone of CHIME BAR BELL

Approved by Investigating Committee of Architects and Engineers; Underwriters' Laboratories, Inc., etc.

Complete information on request

SIGNAL
ENGINEERING & MFG. CO.
162 West 14th St. New York

on for most of your long distance service.

Again coming back to the matter of sufficient revenue, our farmers at Athens pay $1.00 per month for their switching service and get a good grade of service while I understand that here in Caldwell rural service is less than half the price. If you can get a fair grade of service at that price it must be the result of some very economical management. It certainly can't continue good always or very long even.

Oklahoma Utilities Association Convention

The eleventh annual convention of the Oklahoma Utilities Association will be held at Oklahoma City March 12, 13 and 14, 1929.

Much preliminary work has already been done on securing speakers and making other arrangements and indications are that the convention will again break all former records for attendance and quality of program. The coperation of all public utility executives in the state with officials of the Association will make possible a convention which will not only break all former records but will attract attention outside the borders of Oklahoma.

300 Pay Stations Installed at Fort Wayne, Ind.

On January 3, approximately 300 lines of semi-public pay telephones were cut into service in Fort Wayne by The Home Telephone and Telegraph Company.

These semi-public telephones were installed in all public places where the public had access to flat rate telephones. The installations were made generally in cigar stores, drug stores, pool rooms, bowling alleys, restaurants, confectioneries, some groceries, department stores, and any other classes of business where there was public use of telephones.

Subscribers to the semi-public pay station service already have expressed themselves as being greatly pleased with the results obtained.

R. L. Matthews with Wagner Electric Co.

Wagner Electric Corporation announces the addition of R. L. Matthews to the sales force of their Chicago branch office.

Ever since leaving Purdue University where he studied electrical engineering, Mr. Matthews has been active in the electrical field, being connected with such organizations as the Michigan Bell Telephone Company, the Armstrong Cork and Insulation Company, and the National Electric Products Corporation, also Bell Lumber and Pole Company.

Standard Underground Cable Co. Announces Organization Changes

The Standard Underground Cable Company, Division of General Cable Corp., announces the following changes in sales personnel and in branch office locations:

C. J. Marsh, vice president of the Standard Division who, in addition to his other executive duties, was manager of the New York sales office, has been transferred to the staff of General Cable Corporation to supervise the purchase of metals. R. S. Hopkins, assistant manager, has been advanced to manager of the New York office and O. G. Miller made assistant manager.

The Atlanta, Ga., office, formerly a sub-office of Washington, D. C., has been made a main branch sales office and Mr. E. B. Hook, Jr., has been appointed manager and J. A. Peacock district manager. New district sales offices, reporting to the Atlanta office, have been opened in Birmingham, Ala., and Charlotte, N. C., with M. L. Tice and W. D. Hampton as district managers, respectively. The address of the Atlanta office has been changed from Candler Bldg. to Healey Bldg. The Birmingham office is located in the Watts Bldg., and the Charlotte office in the First National Bank Bldg.

Edw. Kerschner, formerly manager of the Washington, D. C., office, was transferred to the Chicago office last August as manager of that territory, and H. C. Richardson has been advanced to manager of the Washington office.

The location of the Chicago office has been changed from Conway Bldg. to the Bankers Bldg. E. J. Pietzcker, formerly manager of both the Chicago and St. Louis offices, is now devoting his entire time to the St. Louis office. The location of the St. Louis office has been changed from the Arcade Building to the Ambassador Building.

Arthur Z. Barnes has been appointed district manager at Dallas, Texas, with offices in the Allen Building. This is a sub-office of St. Louis. Mr. Barnes was formerly with the General Electric Co. of Texas and has a wide acquaintance among Texas public utility officials and other industries.

George C. Knowles, Jr., formerly with Servel, Inc., has been appointed salesman in the Pittsburgh sales office.

Local Phone Company Sells Out

Flora, Ind.—Considerable surprise was occasioned in local business circles Wednesday when it was announced that the Flora Telephone Company, Inc., had disposed of their interests to J. K. Johnson of Indianapolis, who will take possession of the business in ninety days.

Mr. Johnson, who is a telephone man of wide experience, will not move to this city, but will employ a manager, a Mr. Williamson, to take charge of the business, it is understood. Aside from the new manager, there will probably be no change in the personnel of local employees. The consideration of the transaction was not given out by Mr. Knapp.

Mr. Johnson has also purchased the Rossville Telephone Co. plant. Whether this means a co-operative arrangement between the two companies is not known.

The above illustration shows the very elaborate exhibit of the Stromberg-Carlson Telephone Manufacturing Company at the Chicago Convention in October. Several of the Stromberg-Carlson radios are shown in this exhibit.

Telephone Books You Should Have

Makes no difference whether you are Manager, Lineman, Trouble Shooter, Engineer, Operator or Office Boy, you need some of these Books. Look the list over and send us your order.

AUTOMATIC TELEPHONE SYSTEMS. By William Aitken. Covers the whole field of automatic telephony
Vol. I, 297 pages.....$10.00
Contents: Definitions; First Principles; Dial Impulse Senders; Dial Adjustments; Dials, Special Features; Dial Interchangeable Crown Wheel; Telephone Instruments; Strowger System of Automatic Telephone Manufacturing Co.
Vol. II, 230 pages.....$10.00
Contents: Equipment in Subscribers' Offices; Party Line Working.....$12.50

AUTOMATIC TELEPHONY. By Arthur Bessey Smith and Wilson Lee Campbell. New edition, 430 pages, 315 diagrams and illustrations.....$ 5.00

AUTOMATIC TELEPHONES. By F. A. Ellson...$ 1.50

AN OUTLINE OF AUTOMATIC TELEPHONE. By Wm. Aitken.....$ 1.75

DRAKE'S TELEPHONE HANDBOOK. By Prof. D. P. Moreton. 286 pages; 161 illustrations; pocket size, cloth, red edges.....$ 1.50

DRAKE'S RADIO CYCLOPEDIA. By Harold P. Manly.....$ 6.00

ELECTRICAL ENGINEERS' POCKETBOOK. By Horatio A. Foster. 1636 pages; 718 tables; 1128 illustrations.....$ 5.00

ELEMENTS OF RADIO TELEPHONY. By W. C. Ballard, Jr. 140 pages.....$ 1.50
Chapter headings: I—Wire and Radio Telephone Systems. II—High Frequency Currents and Their Production. III—Vacuum Tubes. IV—Vacuum Tube Oscillators. V—Modulator Systems. VI—Receiving Equipment. VII—Transmission. VIII—Miscellaneous. IX—Super-regenerative System.

ENGINEERING ECONOMICS (First Principles.) By John C. L. Fish. 311 pages.....$ 3.00

ENGINEERING VALUATION OF PUBLIC UTILITIES AND FACTORIES. By Horatio A. Foster. 361 pages.....$ 3.00

ELECTRIC WIRING, DIAGRAMS and SWITCHBOARDS. By Newton Harrison.....$ 2.50
Third revised edition. 315 pages, 137 illustrations.

ELEMENTS OF TELEPHONE TRANSMISSION. By H. H. Harrison.....$ 2.00

HAWKINS ELECTRICAL GUIDES—10 volumes; 3,500 pages, 4,700 pictures; pocket size, flexible black covers. Price, payable $1.00 per month, if so desired. Per volume.....$ 1.00
The telephone volumes of this set are: No. 7, 316 pages, 379 illustrations: Alternating Current Wiring; A. C. Wiring Calculations; Telephones; Principles and Construction; Various Systems; Wiring Diagrams; Telephone Troubles. No. 8—332 pages, 436 illustrations: Telegraph; Simultaneous Telegraphy and Telephony; Wireless Principles, Construction, Diagrams; Electric Bells; Electric Lighting; Illumination; Photometry, Etc.

HANDBOOK OF TELEPHONE CIRCUIT DIAGRAMS WITH EXPLANATIONS. By J. M. Heath.....$ 2.50
279 pages, 66 diagrams, 8 folding inserts.

INSPECTION AND TESTING OF MATERIALS, APPARATUS AND LINES. By F. L. Henley....$ 7.00

INTRODUCTION TO WIRELESS TELEGRAPHY AND TELEPHONY. By Prof. J. A. Fleming....$ 1.00
120 pages, illustrations. Cloth.

OPERATORS' WIRELESS TELEGRAPH AND TELEPHONE HANDBOOK. By Victor H. Laughter. 12 mo.; cloth; 210 pages.....$ 1.25

PRINCIPLES AND PRACTICE OF TELEPHONY. By Jay G. Mitchell. Five volumes, 1436 pages, 317 illustrations.....$12.00
Volume I—Principles and Apparatus; 251 pages, 98 illustrations.
Volume II—Circuit Elements and Power Plants; 300 pages, 72 illustrations.
Volume III—Toll Equipment, Traffic and Trunking; 290 pages, 79 illustrations.
Volume IV—Circuit Refinements and Mechanical Switching; 329 pages, 37 illustrations.
Volume V—Mechanical-Manual Switching; 265 pages, 31 illustrations.

PRINCIPLES OF TRANSMISSION IN TELEPHONY. By M. P. Weinbach.....$ 4.00
303 pages. Engineering Science Series.

PRACTICAL TELEPHONE HANDBOOK AND GUIDE TO THE TELEPHONE EXCHANGE. By J. Poole.....$ 5.50
872 pages, with 684 illustrations. A textbook for students of Telephony and a useful Handbook for Operators. Seventh Edition, thoroughly revised and enlarged.

STROWGER SYSTEM OF AUTOMATIC TELEPHONY. By H. H. Harrison. Price.....$ 2.50

SWITCHBOARDS, SWITCHING, PROTECTIVE APPARATUS. By Adams. 125 pages. Cloth binding. A discussion of switchboard equipment, wiring methods, safety devices, etc.....$ 1.50

TELEPHONE CIRCUIT DIAGRAMS. By John M. Heath. 279 pages; 66 diagrams; 8 folding inserts.....$ 2.50
Part I—Local Battery: Local Battery Telephones (10 plates); Local Battery Switchboards (9 plates); Local Battery Party Lines (9 plates); Part II—Common Battery; Common Battery Telephones (9 plates); Common Battery Switchboard (19 plates); Common Battery Party Lines (14 plates).

TELEPHONE CONSTRUCTION, INSTALLATION, WIRING, OPERATION AND MAINTENANCE. By W. H. Radcliffe and H. C. Cushing. 224 pages; 132 illustrations.....$ 1.50

TELEPHONE LAW. By A. H. McMillin.....$ 3.00

TELEPHONE LINE CONSTRUCTION, METHODS AND COST. By Clarence Mayer. 300 pages; 100 illustrations; 157 tables.....$ 3.00

TELEPHONE RATES AND VALUES. By Chas. W. McKay.....$ 4.50

TELEPHONIC TRANSMISSION, Theoretical and Applied. By J. G. Hill. 196 diagrams.....$ 7.50

TELEPHONY. By A. V. Abbott. Set (5 vols.)....$ 6.00
Separately, each..... 1.50

TELEPHONY. By Kempster B. Miller and Samuel G. McMeen.....$ 6.00
Principal subjects (Fundamental Principles): History and development—Acoustics—Electrical reproduction of speech—Electrical signals—telephone lines. (Substation Equipment). Transmitters — Receivers — Primary cells — Magneto signaling apparatus—The hook switch—Electromagnets and inductive coils—Non-inductive resistance devices — Condensers — Current supply to transmitters— etc.

TELEPHONY, INCLUDING AUTOMATIC SWITCHING. By Arthur Bessey Smith. Pocket size, Bound in leatherette, Gold stamping, 500 pages; 263 illustrations and wiring diagrams.....$ 2.50
Contents: Telephone Principles—Local Battery Receiver, Transmitter and Induction Coil—Batteries and Battery Tests—The Magneto and Magneto Signalling; Ringer, Hookswitch and Receiver Cord—The Private Line—Bridging Party Lines—Exchanges and Switchboards—Magneto Switchboard—Combined Drops and Jacks; Ringers and Jacks—Power Ringing—Cord Circuit Apparatus—Repeating Coils—Party Lines, Selective Ringing—Common Battery Switchboards; Simple, Two-Wire and Transfer Types—Common Battery Subscriber's Line—Multiple Switchboard Operation—Feature Boards . . . Automatic Switching; Hundred Line Exchange; Connector Switch, line-switches, Finder Switch—The Automatic Instrument—Series Circuits; Booster Circuits with Polar and Non-polar Receivers—Thousand Line Exchange; Selector Switch, Trunk Slip —(P. B. X.); Measured Service and Pay Stations.

TELEPHONE INSTRUMENTS, THEIR OPERATION, ARRANGEMENT AND MANAGEMENT. By W. H. Radcliffe.....$ 2.00
The purpose of this book is to give a thoroughly practical and complete course of instruction in the operation, installation and maintenance of telephone instruments in so far as they relate to private lines and telephone exchanges. Handsomely bound in cloth and printed in large type on good paper. Contains one hundred and thirty-four pages, with sixty illustrations.

TELEPHONY. By T. E. Herbert.....$ 5.00
884 pages, with 618 illustrations. Cloth.

TOLL TELEPHONE PRACTICE. By Thiess and Joy.....$ 3.50

TRANSMISSION CIRCUITS FOR TELEPHONIC. By K. S. Johnston.....$ 5.00

THEORY OF VIBRATING SYSTEMS AND SOUND. By Crandall.....$ 5.00
282 pages, diagrams. Cloth.

TRANSMISSION LINE FORMULAS. By H. B. Dwight.....$ 3.00
Second Edition, revised and enlarged. 222 pages, folding chart, tables. Cloth.

TELEPHONE COMMUNICATION SYSTEMS. By R. G. Kloeffler. 284 pages.....$ 4.00

WINNING THE PUBLIC. By S. M. Kennedy. The master book on public relations; 148 pages.....$ 2.50

WIRING DIAGRAMS AND DESCRIPTIONS. By Hortsmann and Tousley. 296 pages, 230 illustrations, pocket size.....$ 1.50

ENCLOSE CHECK AND SEND YOUR ORDER TO

TELEPHONE ENGINEER

CHICAGO, ILLINOIS

SCRAP PLATINUM

Highest prices paid for discarded or obsolete telephone and switchboard apparatus; platinum contact relays, ring keys, etc. Have specialized in this field for many years.

CONTACT METALS CO.
2500 S. Wabash Ave., Chicago

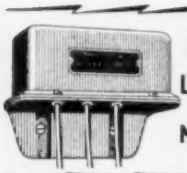
Make Your Directory a Source of Income
Write for Particulars
J. H. WELKER
McKinley Block, Canton, O.
Telephone 8009
DIRECTORY ADVERTISING EXCLUSIVELY

J. G. WRAY & CO.
Telephone Engineers
Specialists in Appraisals, Rate Surveys, Financial Investigations, Organization and Operation of Telephone Companies.
J. G. Wray, Fellow A. I. E. E.
Cyrus G. Hill
Rm. 2130 Bankers Bldg., Chicago

J.K. Johnston, Telephone Engineer
During recent years I have been privileged to appraise Telephone Exchanges all over the United States. The list totals 663. Would you like to avail yourself of my services?
903-4 Lemcke Building, INDIANAPOLIS

EARL L. CARTER
CONSULTING ENGINEER
613 Merchants Bank Bldg. Indianapolis, Ind.
Special attention given to all matters pertaining to Valuations and Investigation of Public Utility Properties.
Formerly Chief Engineer, Public Service Commission of Indiana

ACCOUNTING
Specialization on Public Utility Accounting Records and Audits enables us to best serve Telephone Companies.
HERDRICH AND BOGGS
Certified Public Accountants
1014 Merchants Bank Bldg., Indianapolis, Ind


CHAPMAN
LIGHTNING ARRESTERS
MADE BY
MINNESOTA ELECTRIC CO.
MINNEAPOLIS, MINN.

Phone Adams 5646
Snook, Martin & Co.
Consulting Engineers
40 WEST GAY STREET
COLUMBUS, O.
Make Use of Our Combined Century of Engineering Experience

Richard M. Kerschner of Hubbard & Co., Passes Away

Richard M. Kerschner, associated with Hubbard & Company for the past sixteen years, succumbed to a heart attack on December 8th, 1928, at his home in Zelinople, Pa. His death followed a period of several months' poor health, from which he was apparently recovered to a considerable extent, only to lose out after a sudden illness of a short duration.

Richard M. Kerschner

Upon leaving school Mr. Kerschner obtained a position with the old Chicago Edison Company with which he remained until 1900 when he joined the sales force of the Union Electric Company of Pittsburgh. In 1914 he joined the sales department of Hubbard & Company, later becoming sales manager. In 1924 he supervised the building of the new Hubbard factory at Oakland, Calif., remaining in charge there until 1927, when he returned to Pittsburgh to assume charge of the Department of Development and Research, in which position he was active up to the time of his death. He had built up a host of friends throughout the Central Station men of the country.

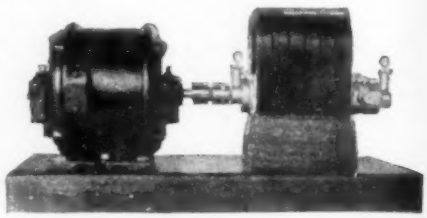
Mr. Kerschner was a member of the A. A. O. N. M. S., the First Presbyterian Church and Sequoyah Club of Oakland, Calif., the Electric League, Chamber of Commerce and the Stanton Heights Golf Club of Pittsburgh. He is survived by his wife, Grace Tebay Kerschner, his sister, Miss Constance Kerschner, and four brothers, E. M., B. M., R. L. and Edward Kerschner.

Direct telephone service was inaugurated this past summer between Czechoslovakia and Hungary.

Suttle Motor Generator Set

For the medium size operating company.

The uniform output of this machine and the great simplicity of its operation makes it especially desirable for operating the ringing circuits of telephone exchanges.



Under ordinary conditions one machine can take care of exchanges up to 1,500 subscribers. It can be attached to a light socket or any other source of appropriate current and aside from watching the oilings, it needs no further attention.

This equipment is free from radio interference with radio sets in common use at this time.

This efficient, low cost device supplies 80 volts, 20 cycle ringing curent. It is entirely new, of our own design and is guaranteed to give satisfactory service.

It is equipped with the most modern type bearings and oiling system—which are the heart of any motor generator. Current consumption very low.

Manufactured by Suttle Equipment Co., Lawrenceville, Ill.

More than 60 per cent of the farms in the State of Missouri have telephones.

Leich Elec. Co. Rebuilt Equipment

Leich Elec. Co. wall automaphones	$ 6.00
Leich Elec. Co. P. M. receivers with rebuffed receiver shells and caps	1.00
Leich D. C. receivers complete	.50
Leich harmonic or pulsating harmonic ringers, 16-33-50-66 cycles, complete with gongs and nuts	1.00
Leich syncromonic ringers, 30-42-54-66 cycles, complete with gongs and nuts	1.25
Leich short compact type switch hook spring assemblies complete with hooks for side wall or shelf mounting	.35
Leich Elec. Co. oak bell boxes for C. B. sets with ringer and condenser and inside connections	2.00
Leich Elec. Co. compact magneto wall sets, enclosed binding post late type, 3-bar 1000 or 1600 ohm	9.00
Same with 5-bar generator	10.00

BUCKEYE TELEPHONE and SUPPLY CO.
COLUMBUS, OHIO

Hotel Empire

BROADWAY at SIXTY-THIRD ST.,
NEW YORK CITY

A New Fourteen Story Fireproof Structure Containing the latest in Furnishings and Equipment.

Capacity 1034

The Location is Unique in the Heart of the Automobile District, with Subway, Elevated Street Cars, Busses—all at door.

RATES

Room, Private Toilet - - -	$2.50
Single Room with Bath - -	3.50
Double Room with Bath - -	5.00

M. P. MURTHA, General Manager *Ample Parking Space*

BANKERS TO THE INDEPENDENT TELEPHONE FIELD

SPECIALISTS, operating independently and not interested in the purchase of properties, we are able to bring unbiased advice and skilled co-operation to your aid.

OUR position enables us to offer well managed companies, permanent financing at attractive rates. We advise you to consult us and obtain definite terms before closing any new financing. There is no cost or obligation in having a member of our organization visit your plant to confer with you.

R. F. DE VOE & CO.

INCORPORATED
120 BROADWAY, NEW YORK CITY
Telephone: RECTOR 7280

ONE MINUTE WALK TO CENTRAL PARK
CONVENIENT TRANSPORTATION to EVERYWHERE
Adjacent to NEW YORKS EXCLUSIVE SHOPPING DISTRICT

La Salle
APARTMENT HOTEL

A DIGNIFIED PLACE of RESIDENCE for PERMANENT and TRANSIENT GUESTS

IN A NEIGHBORHOOD THAT IS SOCIALLY CORRECT

IDEAL FOR WOMEN *with* CHILDREN TRAVELLING ALONE

Personal Direction Of
CHAS LA PRELLE

30 EAST 60th ST

New York

SHERMAN SQUARE HOTEL
70TH ST. & B'WAY NY

CONVENIENT
HOMELIKE
QUIET
COMFORTABLE
EXCELLENT FOOD AT MODERATE PRICES
COURTEOUS SERVICE
SINGLE ROOM AND BATH $2.50
FOR TWO $4.00
REASONABLE RATES
WIRE AT OUR EXPENSE

Home Company of Fort Wayne Host to Employees

More than five hundred persons were in attendance at the annual Christmas party for employes of the Home Telephone and Telegraph Company and their families and friends, held under the auspices of the Company Athletic Association Saturday night, December 22, in the company's recreational center.

The program opened with a playlet, "A Christmas Carol," with the following employes in the cast: Scrooge, Bruce Smith; Jacob Marley, Larry Spindler; Bob Cratchet, Al Hoffman; Fred, Earl Ott; Spirit of Christmas, Alan Brunskill, and Boy, Ed Kruse.

Pupils of Violet Reinwald Prentiss presented five musical comedy acts and Mary Franks Soest and Evelyn Raypole featured with vocal numbers. Community singing was led by Lewis E. Gerding.

F. X. Staub, president of the Athletic Association, in behalf of the employes presented Frank E. Bohn, president and general manager, with a beautiful wardrobe suitcase.

Music for the dancing, which started with a grand march, was provided by Bill Young's Home Telephone orchestra. Santa Claus attended and presented gifts to children and adults. The hall was decorated in Christmas colors under the direction of Art Staub. Refreshments were served at the conclusion of the program.

Henry Krabach was general chairman of the committee on arrangements.

RECONSTRUCTED EQUIPMENT

Kellogg No. 37 1-M. F. Swbd. cord Ckt. condensers @ ..... $ .35
Kellogg, Dean, Stromberg or Auto. Elec. 1-M. F. condensers @ ..... .30
Kellogg, Dean, Stromberg or Auto Elec. 2-M. F. condensers @ ..... .30
Kellogg No. 742 C. B. Steel hotel sets with straight line or 16-33-50 or 66 cycle ringers, equipped with Ind. coil Booster Ckt. @ 6.75
Western Elec. No. 1333 C. B. Steel hotel set with Straight line or 16-33-50 or 66 cycle ringers, equipped with Booster Ind. and W. E. Trans. & Rec. @ 6.75
Kellogg Latest type ringing and Listening Keys with ring back attachment @ 2.25
Reliable Elec. 5 amp. fuses, fit Cook No. 7 Arresters, per hundred @ 3.25
Kellogg No. 41 Receivers, complete with cord and re-polished shells @ 1.35
Western Elec. No. 143 receivers with cord and repolished shells @ 1.25
Western Elec. No. 229 or 250 transmitters with mouthpiece & back @ 1.15
Western Elec. No. 329 or 323 transmitters with mouthpiece & back @ 1.35
North Elec. 4-bar Bdg. hand Generators complete with crank & mounting screws @ $1.50—5-bar @ 1.75
H. C. Ringing machine, motor 110 volt D. C. Generator delivers 80 volts, 20 cycle ringing current—practically new @ 50.00
Kellogg or Stromberg 1000 ohm self contained ringers complete less gongs @ 1.25
Kellogg No. 97 C. B. desk sets complete with No. 75 Straight line Steel signal sets @ 6.75

Write for Our Bulletin

REBUILT ELECTRIC EQUIPMENT CO.
Not Inc.
1940 W. 21st St., Chicago

NEW TELEPHONE EQUIPMENT

We list below a few items of a large lot just received. These are all new, mostly of Holtzer Cabot make.

Wall Telephone, 1,000 and 1,600 ohms, 4-bar bridging and 3-bar, 80 ohm series, less transmitters and receivers, each $1.50.

Hand Generators, 4-bar—each 75c; 3-bar—each 50c.

Extension Bells, 80, 500 and 1,000 ohms, oak and walnut finish, each 50c.

Operators' 80 ohm Receivers with Head Bands, each 50c.

Also many others. Send for complete list of bargains. Electrical Surplus Company, Dept. T, 1911 Chicago Ave., Chicago.

FOR SALE—Three switchboards, 50 to 150 capacity, popular makes, rebuilt; low prices. G. W. Beach, Box 146, Cedar Rapids, Iowa.

WANTED—Iowa man wants short time jobs repairing switchboards, etc. Reliable references. Geo. Bishton, Box 645, Cedar Rapids, Iowa.

FOR SALE

2 conductor black silk desk stand and receiver cords, per set, 40 cents. W. E. No. 47 porcelain fuses, $7.00 per 100. W. E. No. 14 cable terminals, 16 pair, less stubs @ $4.00. W. E. NEW 2 conductor swbd. cords with No. 109 plugs attached, 50 cents. Galvanized steel cross arm pins, $5.00 per 100.

The Telephone Repair Shop
6966 Ravenswood Avenue
Chicago, Illinois

UNIQUE FURNACE

GASOLINE—KEROSENE

PATENTED ARRANGEMENT FOR DISLODGEING COIL WITHOUT TEARING DOWN FURNACE
PATENTED SEAMLESS TUBING COIL GENERATOR
IMPROVED ONE PIECE BURNER
HAND HOLD FOR CLEANER ONE TURN CLEANS ORIFICE
AUTOMATIC ORIFICE CLEANER
AUTOMATIC PUMP INSIDE TANK
16 GUAGE STEEL TANK WELDED BOTTOM

10 MINUTES TO MELT 50 lbs. OF SOLDER

But—more important—

The experienced cable splicer will be surprised at the length of time it will remain in the field without attention!

Literature?

UNIQUE MANUFACTURING CO., Inc
221 Whiting St. Chicago, Ill.

PEARL LIFE-TIME DROP WIRE BRACKETS

Save time, labor and waste. Hot-galvanized screw-hooks and malleable castings are separable and indestructible. Standard 2 groove porcelain. Stocked by telephone manufacturers.

WM. H. PEARL CO., Indianapolis

Send for free sample and prices on

UNIVERSAL DROP WIRE INSULATORS

Universal Specialty Company
711 Poplar St., Terre Haute, Ind.

Get your
Telephone Repair Work
done at the old reliable
Telephone Repair Shop
SUTTLE EQUIPMENT CO.
LAWRENCEVILLE, ILL.

The Comfortable
Great Northern Hotel
CHICAGO

TRAVELERS select the Great Northern for its wonderful location in Chicago's "loop". They return because the large comfortable rooms, homelike environment, attentive service, excellent food and moderate charges make it an ideal hotel.

400 Newly Furnished Rooms
$2.50 a day and up

Sample Rooms
$4.00, $5.00, $6.00
$7.00 and $8.00

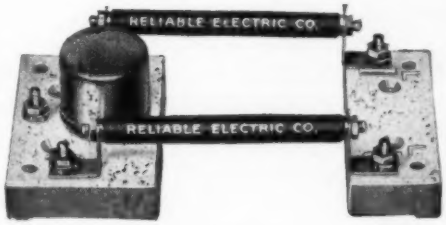
WALTER CRAIGHEAD
Manager

Dearborn St. from Jackson to Quincy
New Garage One-Half Block

Protection

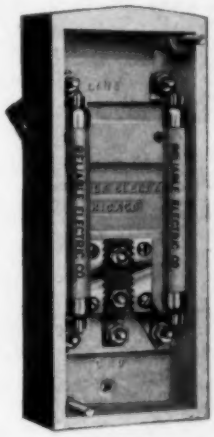
INDIVIDUAL STATION ARRESTERS

Listed As Standard By Underwriters' Laboratories

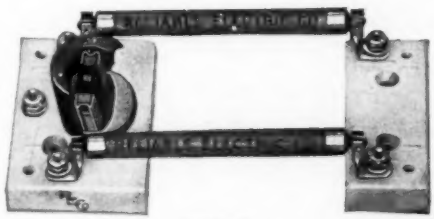


977HH

Sawtooth Types



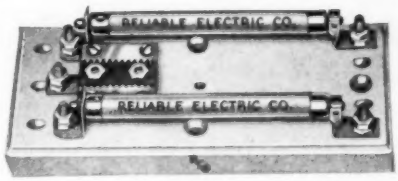
997B



977DD

Self Cleaning

997B
With Cover



998C

Low Maintenance

"the choice of the majority"

Reliable Electric Company

3145 Carroll Ave. Chicago, Ill.

TELEPHONE ENGINEER

192 N. Clark St., Chicago. Telephone STAte 2657

PUBLISHED MONTHLY BY

TELEPHONE ENGINEERING PUBLISHING COMPANY

J. A. SMITH, 192 N. Clark St., Chicago, President and Treasurer
C. L. JONES, Athens, Ohio, Vice-President
D. WEINER, 192 N. Clark St., Chicago, Secretary
F. A. BOWDLE, Cerro Gorda, Illinois, Vice-President

No. 2 1929
Vol. 33 February

SUBSCRIPTIONS:—The subscription price of TELEPHONE ENGINEER is $2.00 a year in the United States, Cuba and Mexico; in Canada it is $3; in all other countries $4. Single copies, U. S. A., 20 cents.

Entered as second-class matter, June 6, 1922, at the post office at Chicago, Ill., under the act of March 3, 1879

Table of Contents

Editorial 15-16
Get Tools Ready Early—Attend Your State Convention—Will Pay Stations Pay?—Tinkering with Commission Laws—Why Not Local Cut Rates?

Telephone Circuits from a General Aspect, by F. J. Dommerque 17-18-19-20

Studying Telephone Methods, by E. R. Collins 21-22-23-24

Meeting of Program Service Association Shows Material Progress Past Year 24

Practical Suggestions for Plant Valuation, by Charles W. McKay 28-30-32

Who's Who in the Telephone Business 34

Important Development in Telephone Acquisition by Ohio Group, by R. F. DeVoe & Co 38

Line & Desk 42-44

Minnesota Convention at St. Paul Draws Record Attendance in 1929 44

Bugs We Have Shot, by Ray Blain 46-48

South Dakota Holds Its Annual Convention at Sioux Falls, S. D. 48

Index to Advertisers

American Cross Arm & Conduit Co 12
American Electric Co., Inc 31
American Steel & Wire Co ..... —
American Telephone & Telegraph Co 29-39
Automatic Electric Co 26-27

Bell Lumber & Pole Co 12
Bernz Co 8
Blake Signal & Mfg. Co 10
Block, Lynton T., & Co 41
Bowdle Accounting System ..... —
Buckeye Telephone & Supply Co 49

Carbon Products 13
Chance Company 12-50
Chicago Solder Co 45
Colson Co., The 2
Contact Metals Co 50
Cook Electric Co 14
Copperweld Steel Co 2
Curtin-Howe Corp 1

DeVoe & Co., R. F 25

Earl L. Carter 49
Electric Storage Battery Co 45
Everstick Anchor Co 50

French Battery Co 35
Graybar Elec. Co 33

Herdrich & Boggs 49
Holtzer-Cabot Electric Co 8
Hotel Empire 25
Hotel, Great Northern 50
Hotel La Salle ..... —
Hubbard & Co 12

Indiana Steel & Wire Co 13
International Creo. & Con. Co 52

Johnson, A. J., Elec. Co., Inc ..... —
Johnson, J. R 49

Kearney Corp., Jas. R 1
Kellogg Switchboard & Supply Co 4-5

Long-Bell Lumber Co 45

Matthews Corp., W. N 3
MacGillis & Gibbs 12
Minnesota Electric Co 49
Miller, Wm. M ..... —

National Cable Compound Co 10
National Carbon Co 11
Naugle Pole & Tie 12
Northern White Cedar Ass'n 47

Premier Electric Co 10
Prest-O-Lite Co., Inc 13
Pettyman & Sons, J. F 43

Rebuilt Electric Equipment Co 50
Reliable Electric Co 9
Republic Cedar Co 12

Sand Electric Co 1
Snook, Martin & Co 49
Signal Eng. & Mfg. Co 8
Standard Underground Cable Co 45
Stewart Bros. 10
Stromberg-Carlson Tel. Mfg. Co 6-7

Telephone Repair Shop 49
T. M. Partridge Co 12
Texas Creosoting Co 10

Universal Specialty Co 50
Unique Mfg. Co 50

[illegible] 49
Western Electric 37
Wm. H. Pearl 50
Wray & Co., J. G 49

Get EVER-PROTECT aid in your construction.

EVER-PROTECT has proved practical and profitable in making many hundreds of cable installations underground without a conduit. It protects cable against storm damage, corrosion, chemical action, electrolysis and abrasion.

In liquid form EVER-PROTECT is great for overhead work, protecting your cable and messengers against chemical action and other destructive influences.

Ask your nearest jobber for complete details.

National Cable Compound Co.
Incorporated
MITCHELL - - IND.

"REBUILT" TELEPHONE APPARATUS and exchange equipment saves you 30 to 50 per cent without sacrificing quality or efficiency.

SWITCHBOARDS—Telephones—Apparatus—Protection Equipment—Cable—Everything you need for the installation and operation of a complete exchange—Magneto or Central Energy—of the best and most reputable manufacturers.

Fourteen years' successful operation of our rebuilt equipment department puts it past the experimental stage. Quality and price will make you a permanent customer. Better investigate.

BARGAIN BULLETIN NO. 78 FREE

Address "REBUILT" EQUIPMENT DEPARTMENT
Premier Electric Company 1800-4 Grace St. Chicago, Ill.

"BLACK BEAUTY" POLES

Cost less per mile, per year, than untreated poles of any species.

American Electric Company, Inc.

Distributors of "Black Beauty" Poles and Cross Arms to the Independent Telephone Trade

State and 64th Streets : : Chicago, Ill.

Branch Office and Warehouse: 622 Wyandotte St., Kansas City, Mo.

Note Protection at Corners

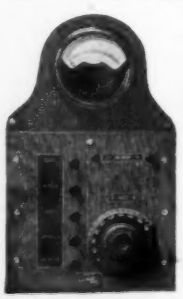
Blake Insulated Staples

Trade Mark

Unequalled for telephone and bell wiring. The fiber insulation prevents troublesome short circuits and grounds. 4 sizes. Pat. Nov., 1900. Write for samples.

Blake Signal & Mfg. Co.
BOSTON, MASS.

The "STEWART" Direct Reading Test Cabinet



Measures shorts, crosses and ground direct in ohms. Resistance to trouble is read off the scale the same as volts off a voltmeter.

Any telephone man can install it and use it. Will save many times its cost in a year.

It costs more to do without the Test Cabinet than to buy one. Write for circular. Sent on trial.

Also, Test Sets, Cable Testers and Detecto-Meters.

STEWART BROTHERS
OTTAWA, ILLINOIS